

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

CALLAWAY GOLF COMPANY

Plaintiff,

v.

ACUSHNET COMPANY,

Defendant.

C.A. No. 06-91 (SLR)

JURY TRIAL DEMANDED

PUBLIC VERSION

**ACUSHNET'S REPLY BRIEF IN FURTHER SUPPORT OF ITS
MOTION FOR PARTIAL SUMMARY JUDGMENT
THAT U.S. PATENT NO. 4,431,193 TO NESBITT INCORPORATES
U.S. PATENT NO. 4,274,637 TO MOLITOR BY REFERENCE**

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I. INTRODUCTION

Callaway's patents-in-suit are invalid. Faced with an unassailable array of prior art references that clearly anticipate or render obvious its patents, Callaway can do little meritoriously to save them. Thus, Callaway's opposition mischaracterizes the teachings of the Nesbitt and Molitor '637 patents, and makes clumsy attempts to distinguish controlling case law—case law that mandates a finding that Nesbitt incorporates Molitor '637 by reference.

Callaway also wrongly suggests that Acushnet's invalidity case depends upon Nesbitt incorporating Molitor '637 by reference [D.I. 242 at 1-2], which it does not. Even were the Court to find that Nesbitt does not incorporate Molitor '637 by reference (which it does), these two references provide one of the clearest § 103 invalidity combinations as against the patents-in-suit. Finally, Callaway relies unconvincingly upon the testimony of Mr. Nesbitt, now its paid consultant, as well as its purported expert, Mr. Risen, to inject irrelevant subjectivity into the objective legal inquiry of incorporation by reference, which also fails. In the end analysis, Callaway has not set forth any basis to deny Acushnet's Partial Motion for Summary Judgment that Nesbitt Incorporates Molitor '637 by Reference [D.I. 201], and that Motion should be granted. Callaway's Motion for No Anticipation [D.I. 200] should be denied.

II. CALLAWAY MISREADS THE DISCLOSURE OF NESBITT AND MOLITOR '637

Throughout its brief, Callaway characterizes a number of the *explicit* teachings of Nesbitt and Molitor '637 as being the use of improper "hindsight." [D.I. 242 at 12-13]. Callaway ignores the teachings in Nesbitt itself that provide the specific instructions to use the compositions of Molitor '637 as the hard inner cover and soft outer cover of Nesbitt's three-piece ball. *See* D.I. 205, Ex. 1, Nesbitt '193, col. 3:56-61. Following the express teachings of the prior art is not "improper hindsight."

Yet one wonders what could be clearer than, "[r]eference is made to [Molitor '637] which

describes a number of foamable compositions of a character which may be employed for one or both layers **14** and **16** for the golf ball of this invention.” *Id.* Acushnet relies only on the statements found in the references themselves, which are unambiguous. Callaway, on the other hand, applies inappropriate hindsight “interpretations” to these unambiguous statements.

A. Molitor ‘637 Does Not Disclose “Hundreds of Foamable Compositions”; Tables 1-12 Disclose Eight Compositions

Callaway’s description of Molitor ‘637 contains numerous inaccuracies. Callaway argues that Molitor ‘637 contains “literally hundreds” of golf ball cover compositions [D.I. 242 at 1, 10], but that assertion is untrue. The Court can easily see this for itself just by reading Molitor ‘637. [See D.I. 205, Ex. 2, Molitor ‘637, cols. 12-19, Tables 1-12].

In fact, the only list that Callaway identifies, from column 5 of Molitor ‘637, does not identify any specific cover layer compositions—that list describes only certain classes of materials. Molitor ‘637 sets forth its foamable cover compositions in cover composition tables, of which there are twelve. [See D.I. 205, Ex. 2, Molitor ‘637, col 12, lines 19-27 (“The term “consisting of” as used in the definition of the ingredients present in . . . the *below listed examples* is intended to exclude the presence of other materials in such amounts as to interfere substantially with the properties and characteristics possessed by the *composition* set forth”), Tables 1-12 of Molitor ‘637.] In these tables are set forth eight different cover compositions, with Tables 1-5 repeating the same ionomer cover composition, Table 10 setting forth a polyurethane cover composition, and Tables 6-9, 11 and 12 setting forth six other compositions. Thus, the facts are that Molitor ‘637 discloses only *eight* foamable golf ball cover compositions, not the “hundreds” of compositions that Callaway suggests are present.

[REDACTED]

However, the description of Molitor ‘637 as disclosing “a number of foamable compositions” comes from the

reference itself—*the Nesbitt patent itself uses these exact words*. [See D.I. 205, Ex. 1, Nesbitt, col. 3, lines 56-61 (“Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Patent No. 4,274,637 which describes a *number of foamable compositions* of a character which may be employed for one or both layers 14 and 16 for the golf ball of this invention.”)]. It thus appears that Dr. Risen not only disagrees with Acushnet’s interpretation of Nesbitt, but argues that Nesbitt does not say what it in fact says. Such *ipse dixit* expert testimony, that contradicts a plain reading of the art, is of no probative value whatsoever. See *Default Proof Credit Card Sys., Inc. v. Home Depot U.S.A., Inc.*, 412 F.3d 1291, 1300 n.2 (Fed. Cir. 2005) (finding no error in decision not to rely on portions of expert testimony that “were either unsupported or contradicted by the express language of the written description”) (citation omitted).¹

**B. Molitor ‘637 Discloses Only One Ionomer Composition—
Callaway Has Not Explained How This *Single* Composition
Can Satisfy Nesbitt’s Reference To Multiple Foamable
Compositions**

Callaway argues unconvincingly that if Nesbitt refers to any specific compositions at all then it must refer only to the ionomer compositions of Molitor ‘637, and no others. [D.I. 202 at 9-11.] This argument too is flawed. Nesbitt does not refer to the “ionomers” in Molitor ‘637, but to its “number of foamable compositions.” Callaway is imposing a limitation into Nesbitt’s incorporation language that simply is not present.

Furthermore, Nesbitt specifically identifies that there are “a *number* of foamable compositions” in Molitor ‘637. This is a reference to more than one foamable composition. Yet,

¹



among the eight foamable compositions in Molitor ‘637, only one of these contains an ionomer. See D.I. 205, Ex. 2, Tables 1-5 (setting forth the same ionomer composition). Compare with Tables 6-12. Thus, Nesbitt refers to more than just ionomers when it refers to Molitor ‘637’s “foamable compositions.” Callaway’s attempt to read “a number of foamable compositions” as identifying only a single, ionomer composition should be dismissed.

Callaway also rehashes its argument that because Nesbitt describes ionomers as a preferred embodiment, and because Molitor ‘637 does not identify polyurethanes as a preferred embodiment, Nesbitt and Molitor ‘637 “teach away” from the polyurethane and other non-ionomeric materials disclosed in Molitor ‘637.² This argument misstates the law. The law is that “[a] statement that a particular combination is not a preferred embodiment does not teach away absent clear discouragement of that combination.” See *Syntex L.L.C. v. Apotex, Inc.*, 407 F.3d 1371, 1380 (Fed. Cir. 2005), *aff’d*, 221 Fed. Appx. 1002 (Fed. Cir. 2007). Also, even if these references taught away from the relevant combination (which they do not), such is of no relevance to the incorporation inquiry. See *S. Clay Prods. v. United Catalysts, Inc.*, 64 U.S.P.Q.2d 1606, 1610 (Fed. Cir. 2002) (nonprecedential) (“Teaching away, however, is neither relevant to the question of anticipation nor to the question of incorporation by reference.”).

III. CALLAWAY CANNOT DISTINGUISH NESBITT AND MOLITOR ‘637 FROM THE CASES RELIED UPON BY ACUSHNET

A. *Advanced Display*

Callaway relies heavily on its reading of *Advanced Display Sys., Inc., v. Kent State Univ.*, 212 F.3d 1272 (Fed. Cir. 2000) to support its argument of non-incorporation. Notably, Callaway does not cite or discuss any Federal Circuit cases that have interpreted and applied the incorporation by reference test set forth in *Advanced Display*.

² Nesbitt also refers to both *natural and* synthetic materials as suitable for the ball’s cover layers. D.I. 205, Nesbitt, Ex. 1, col. 3, lines 53-54. As ionomers are not natural, Nesbitt’s focus is not limited to ionomers, as Callaway contends.

These cases make clear that Callaway is attempting to apply *Advanced Display* in an inappropriately restrictive way. For example, in *Cook Biotech Inc. v. Acell, Inc.*, 460 F.3d 1365 (Fed. Cir. 2006), the Federal Circuit recently revisited the issue of incorporation by reference, and in that case, the host document, U.S. Patent No. 5,554,389 (Ex. 5), used the following incorporation language: “The preparation of UBS from a segment of urinary bladder is similar to the procedure for preparing intestinal submucosa detailed in U.S. Patent No. 4,902,508, the disclosure of which is expressly incorporated herein by reference.” *Id.* at 1375. Notably, the host reference did not contain *any* mention of where in the ‘508 patent this disclosure could be found. Nevertheless, in applying *Advanced Display*, the Court found that the ‘389 patent effectively incorporated the ‘508 patent by reference. *Id.* at 1377.

Similarly, in *Sys. Div., Inc. v. Teknek LLC*, 59 Fed. Appx. 333 (Fed. Cir. 2003), the Federal Circuit applied *Advanced Display* inconsistently with Callaway’s reading. In that case, the Federal Circuit found that U.S. Patent No. 5,813,073 incorporated U.S. Patent No. 5,349,714 by reference. *Id.* at 340. The incorporation language in the ‘073 patent reads as follows: “This invention is an improvement to the sheet cleaning apparatus described in U.S. Pat. No. 5,349,714, the entire contents of which are incorporated herein by reference.” U.S. Patent No. 5,813,073 (Ex. 6) col. 1, lines 10-12. *See also S. Clay Prods. v. United Catalysts, Inc.*, 64 U.S.P.Q.2d at 1611 (finding incorporation by reference of patent with no identification by host document of where material is found in the patent). Hence, the Federal Circuit has not required that a host document identify where the material is found in the referenced document in any case where it has applied *Advanced Display*. Callaway’s arguments contradict the most recent law on this subject.

Callaway’s discussion of *Advanced Display* itself is also incomplete. The Haas patent, the host document in *Advanced Display*, did not refer to only a single patent, as Nesbitt refers to Molitor ‘637. Instead, Haas purported to incorporate several patents and publications. The teachings of Haas and several of these incorporated patents had to be combined in order to invalidate the claims at issue. *See, e.g.*, U.S. Patent No. 4,097,127 (Ex. 7) col. 3, line 49—col. 4,

line 4. The situation in *Advanced Display* is thus quite distinguishable from this case, where Nesbitt incorporates only one reference, refers in its incorporation specifically to the foamable compositions of that one reference, and only that single reference's foamable compositions are necessary in combination with Nesbitt to invalidate Callaway's asserted claims.

Furthermore, it is important to be reminded that in *Advanced Display* the Federal Circuit did not even determine whether the Haas patent incorporated its various documents by reference. Instead, it remanded the issue to the district court for further consideration. Callaway appears to suggest that the Federal Circuit somehow had already determined that the incorporations by reference in Haas were ineffective. But that is nowhere to be found in *Advanced Display*. It also does not appear that the district court ever applied the Federal Circuit's test to determine whether Haas incorporated these other patents by reference. Callaway's attempts to compare Nesbitt to Haas are hence of no value, as apparently no determination was ever made whether and to what extent Haas incorporated the numerous materials it referenced.

B. Callaway Quotes *In re de Seversky* Out of Context

As stated in Acushnet's Reply to Callaway's Motion for Summary Judgment of No Anticipation, Callaway quotes *In re de Seversky*, 474 F.3d 671, 674 (C.C.P.A. 1973) entirely out of context. In that case the applicant argued that because an application is identified as a continuation-in-part of its parent, it thereby incorporates the contents of its parent application by reference. *Id.* at 673-74. The CCPA found that this "reference" was not adequate to effect an incorporation by reference. *Id.* at 674. It is in this context that the CCPA made the statement that "mere reference" to another application is not an incorporation by reference. That is, merely claiming priority back to a parent application does not effectuate an incorporation by reference of the parent application. Notably, unlike *Seversky*, Nesbitt teaches both the materials in Molitor '637, and exactly how to use those materials.

C. Callaway's Efforts To Distinguish Other Cases Actually Show How Precise Nesbitt's Incorporation Language Is—Nesbitt Provides Specific Instructions to Construct the Claimed Invention

Callaway also unsuccessfully attempts to distinguish *Southern Clay*, *In re Voss*, 557 F.2d 812 (C.C.P.A. 1977) and *In re Hughes*, 550 F.2d 1273 (C.C.P.A. 1977) from Nesbitt. For instance, Callaway argues that Acushnet is not simply incorporating material from one reference into another as in those cases, but “is manipulating the materials into the particular two-layered arrangement in the asserted patents.” [D.I. 242 at 12]. However, it is not Acushnet that is “manipulating these materials into the two-layered arrangement in the asserted patents.” *Nesbitt itself* teaches this “manipulation” when it instructs that Molitor’s materials should be arranged in the two-layer construction: “[Molitor ‘637’s] foamable compositions . . . may be employed for one or both layers 14 and 16 for the golf ball of this invention.” [D.I. 205, Ex. 1, col. 3, lines 56-61].

Further, Nesbitt goes on to describe the relationships of the foamed layers, indicating that the harder layer should be the inner layer, which should be less foamed (or even “unfoamed”), and the outer cover should be comparatively soft. *Id.* at col. 3, line 61-col. 4, line 2.

Callaway also argues that it would take a “cafeteria-style selection” from hundreds of possible materials to reconstruct the patents-in-suit from these two references. [D.I. 242 at 1]. This is a gross overstatement. As Nesbitt incorporating Molitor ‘637’s foamable compositions is treated as one reference, no such “selection” of materials need be made—all of the elements claimed by the patents-in-suit are taught in this one reference. While Callaway, Mr. Nesbitt, and Dr. Risen, apparently wish to disavow knowledge of what this reference plainly teaches, the hypothetical person of ordinary skill is presumed to have this knowledge.

Callaway also implies that *Voss* and *Hughes* are somehow no longer good law. But both *Voss* and *Hughes* were decided after *In re de Seversky*, the case relied upon and quoted out of context by Callaway. *Voss* applied the same rule as *In re de Seversky* to the references at issue. See *In re Voss*, 557 F.2d at 817 (“the incorporation by reference in an application of matter

elsewhere written down . . . by means of an incorporating statement clearly identifying the subject matter which is incorporated and where it is to be found. *In re de Seversky*, 474 F.2d at 674.”). And it is verifiably the same rule cited with approval by *Advanced Display* from *In re de Seversky*. See *Advanced Display*, 212 F.3d at 1282 (describing *In re Seversky* as “providing that incorporation by reference requires a statement ‘clearly identifying the subject matter which is incorporated and where it is to be found.’”). Furthermore, the Federal Circuit has quoted and relied upon both *Voss* and *Hughes* post *Advanced Display*.

Finally, unlike the host references in most of those cases, Nesbitt provides *specific instructions* to utilize the compositions of Molitor ‘637 in a three-piece golf ball—none of the other cases provide such detailed instructions but, as Callaway correctly indicates, only incorporate “a background discussion.” [D.I. 242 at 12]. Hence, Nesbitt not only incorporates Molitor ‘637’s compositions, it breathes life into them by stating that should be arranged in the manner claimed by the patents-in-suit.

IV. CALLAWAY’S EXTRINSIC EVIDENCE IS IRRELEVANT TO THE LEGAL QUESTION OF INCORPORATION BY REFERENCE

[REDACTED]

[REDACTED]

All in all, Callaway spends a great deal of its brief citing to extrinsic, subjective sources in an effort to muddle a question of law that must be determined from the language of the documents themselves. *See Advanced Display Sys.*, 212 F.3d at 1283 (“Whether and to what extent material has been incorporated by reference into a host document is a question of law.”). Acushnet, on the other hand, relies upon the plain language of Nesbitt and Molitor ‘637.

V. CALLAWAY’S RELIANCE ON THE PTO IS MISPLACED IN THIS INSTANCE

Callaway relies upon a decision of the Patent Examiner in the reexamination proceedings as evidence that Nesbitt does not incorporate Molitor ‘637 by reference. The Examiner found that Nesbitt did not incorporate Molitor ‘637 by reference based solely on a review of the current version of the Manual of Patent Examining Procedure § 608.01(p) (Ex. 8) directed to incorporation by reference. [See D.I. 185, Ex. 3, at 13-14].

The current MPEP, which is in its Eighth Edition, refers to the bright line test of 37 CFR 1.57(b)(1), which has a recent effective date of October 21, 2004.³ In particular, today’s MPEP states that “37 CFR 1.57(b)(1) limits a proper incorporation by reference (except as provided in 37 CFR 1.57(a)) to instances only where the perfecting words ‘incorporated by reference’ or the root of the words ‘incorporate’ (e.g., incorporating, incorporated) and ‘reference’ (e.g., referencing) appear.” MPEP 608.01(p) (Original Eighth Ed., August 2001, August 2006 rev.). (Ex. 8). As Nesbitt does not use the word “incorporate,” the Examiner found that it did not incorporate Molitor ‘637 by reference. [D.I. 185, Ex. 3, at 13-14].

Twenty-six years ago, however, when the Nesbitt application was filed in August 1981, the MPEP was only in its Fourth Edition and a different practice was authorized for incorporation by reference. MPEP 608.01(p) stated then that “The referencing application must

³ 69 FR 56539, Sept. 21, 2004.

include . . . *an identification of the referenced patent or application*, Particular attention should be directed to specific portions of the referenced patent or application.” MPEP § 608.01(p)B (Fourth ed., Rev. 7, July 1981) (D.I. 238, Ex. 7) (emphasis added). No specific “incorporation by reference” language or other magic words were required by the regulations then to incorporate by reference in the eyes of the PTO. Therefore, when applying the PTO’s earlier standard for incorporation by reference, the following passage from Nesbitt properly incorporates Molitor ‘637 by reference:

The inner, intermediate, or first layer or ply 14 and the outer cover, second layer or ply 16 or either of the layers may be cellular when formed of a foamed natural or synthetic polymeric material. Polymeric materials are preferably such as ionomer resins which are foamable. Reference is made to the application Ser. No. 155,658, of Robert P. Molitor issued into U.S. Pat. No. 4,274,637 which describes a number of foamable compositions of a character which may be employed for one or both layers 14 and 16 for the golf ball of this invention.

D.I. 205, Ex. 1, Nesbitt, col. 3, ll. 51-61.

Here, Nesbitt identified both the referenced Molitor application serial number (Ser. No. 155,658) and patent number (U.S. Pat. No. 4,274,637), and directed attention to the specific subject matter (foamable compositions) that were incorporated into Nesbitt. The fact that the Patent Rules and MPEP changed nearly a quarter century later does not nullify Nesbitt’s incorporation, which fully complied with the procedures in place as of its 1981 filing date.

Incorporation by reference should be judged, we submit, by the law and PTO practice in force at the time the incorporating reference was filed. Acushnet has asked the PTO to so find and believes the Court should likewise judge Nesbitt’s language based on Federal Circuit law and the MPEP provisions that existed at the time Nesbitt filed his application.

VI. RATHER THAN TRYING TO ADDRESS ACUSHNET’S ARGUMENTS ON THE MERITS, CALLAWAY ATTEMPTS TO REHASH A SIX YEAR OLD NEGOTIATION WITH ACUSHNET

[REDACTED]

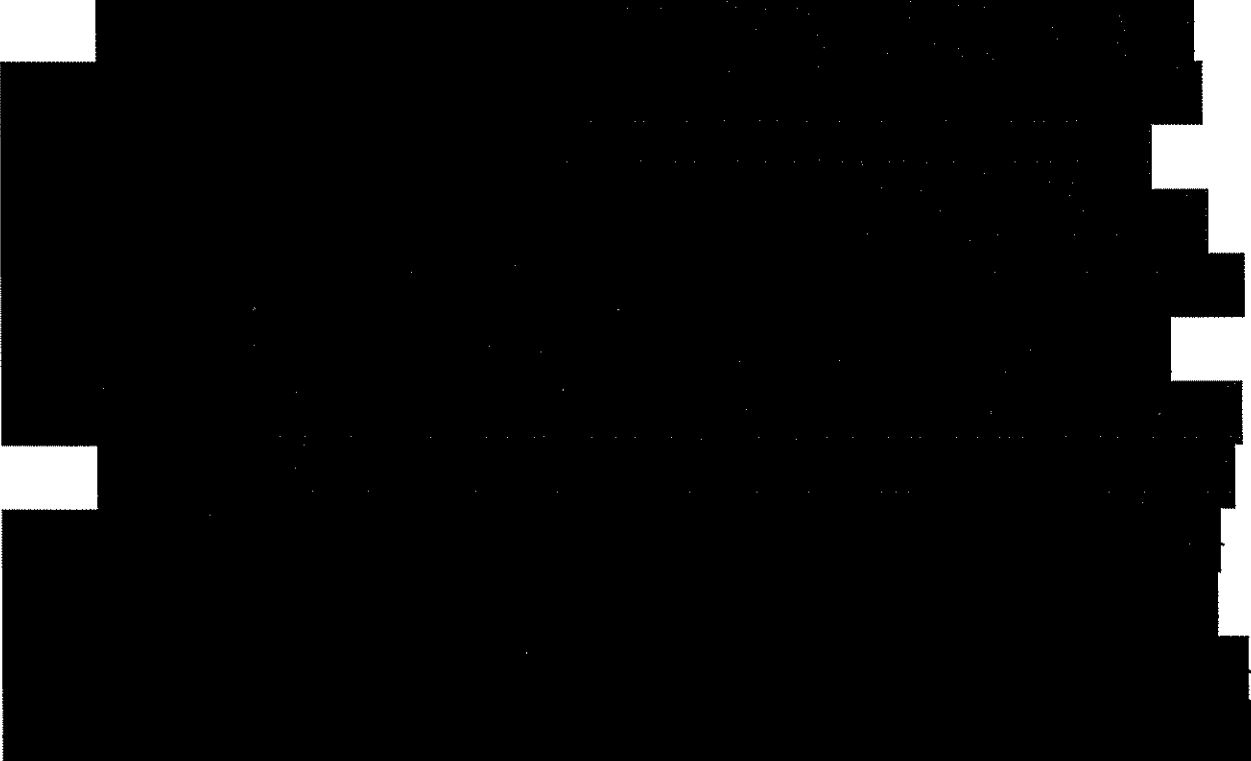


Second, throughout this case, Callaway has referred to the patents-in-suit as its “earlier-filed patents” on the same technology as Hebert. [See, e.g., D.I. 242 at 6]. This statement is also inaccurate. The applications leading to the patents-in-suit were not filed until *after* the Hebert patent issued. Three of the patents-in-suit were not even filed for until after the Pro V1 was on the market.⁴ Thus, it was only after others disclosed their urethane-covered balls that Spalding submitted continuations of applications that it had kept pending for years on what it has described as this “same technology.”

It is this type of exploitation of the patent continuation process that has recently spurred the PTO to propose amendments to its rules that would limit continuation applications and curtail such abuse of the patent continuation process. As the PTO stated in a recent posting in the Federal Register, “it appears that some applicants and practitioners have used multiple continued examination filings as a strategy to delay the conclusion of examination. The Office, however, considers such a strategy to be a misuse of continued examination practice. . . . This misuse of continued examination practice also prejudices the public by keeping applications in pending

⁴ The ‘293 patent application was filed on December 21, 1999. The Hebert patent had issued just months earlier, in March 1999. The other patents-in-suit’s applications were filed in 2001. Mr. Sullivan had left Spalding before any of these applications were filed.

status *while awaiting developments in similar or parallel technology and then later amending their application to cover these developments.*" Fed. Reg. Vol. 72, No. 161, 46719, August 21, 2007 (Ex. 10). Following the "strategy" described by the PTO is precisely how Spalding acquired the patents-in-suit.



⁵ Nesbitt discloses Surlyn 1605 as the inner cover layer. The flexural modulus of this material is 51,000 psi. Molitor '637 discloses a blend of Surlyn 1605 and Surlyn 1557 the flexural moduli of these materials are 51,000 and 32,000 respectively. *See* [D.I. 216, Ex. 37].

VII. CONCLUSION

As Callaway has not demonstrated in its Opposition that Acushnet's Motion for Partial Summary Judgment that Nesbitt Incorporates Molitor by Reference should be denied, Acushnet requests that Motion be granted, and that Callaway's Motion for No Anticipation be denied.

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**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

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EXHIBIT 4

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Callaway Golf Company v. Acushnet Company

William Risen

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IN THE UNITED STATES DISTRICT COURT
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Plaintiff,

vs.

Civil Action No.
06-91 (SLR)

ACUSHNET COMPANY,

Defendant.

Boston, Massachusetts
Friday, July 20, 2007
Volume I of II

Videotaped Deposition of
WILLIAM M. RISEN, JR., Ph.D.

The witness was called for examination by
counsel for the Defendant, pursuant to notice,
commencing at 9:41 a.m. at the Law Offices of Fish &
Richardson, P.C., 25 Franklin Street, Boston,
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William Risen

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1 I think when they were writing this, they had certain
2 kinds of things in mind and then said, "Whoops.
3 Maybe you can put this cover on a ball like Nesbitt
4 reported" and then stuck that sentence in.

5 BY MR. ROSENTHAL:

6 Q. But it certainly states that you could use
7 the -- or this in combination with the previous
8 couple paragraphs --

9 A. Well, it does so --

10 Q. -- state that the cover material of this
11 invention can be used on the Nesbitt ball, right?

12 A. It does so indirectly by redefining what
13 "two-piece ball" means.

14 Q. Okay.

15 A. Yes.

16 Q. Now, regardless of whether the combination
17 of Nesbitt and Molitor '751 actually discloses all of
18 the elements of the claims -- let's put that question
19 aside for a second -- I'd like to ask you whether it
20 would have been obvious to a person of ordinary skill
21 in the art to take the cover described -- covers
22 described by the Molitor '751 patent and apply them
23 to the outer cover layer of the Nesbitt patent?

24 A. Well, I think if people -- a person of
25 ordinary skill in the art read this, they would think

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1 it was about two-piece balls; and maybe if they went
2 back and said, "Oh, there's a special definition of a
3 two-piece that doesn't mean two, it means three,"
4 they might have said to themselves "Maybe you could
5 do something."

6 But it's so clearly an add-on with
7 some special meaning that I don't think most people
8 in the art would read it this way. I think they
9 would just say, "This is a two-piece ball patent."

10 Q. So if a person of ordinary skill in the art
11 had in front of him the '751 patent and the Nesbitt
12 patent with this description, you don't think that it
13 would be obvious, given those two disclosures, to
14 take the '751 cover material and put it on the
15 Nesbitt construction?

16 A. I'd be surprised if most people with
17 ordinary skill in the art would do that kind of close
18 reading and figure out the -- what they really mean
19 is that two could be equal to three. I can see the
20 logic of making some kind of connection. But I don't
21 think somebody with ordinary skill in the art would
22 read this as anything much more than a two-piece ball
23 patent.

24 Q. They would just gloss over this reference
25 to Nesbitt?

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1 A. I think so, yes. And -- Well, that's how
2 people work. But they might have -- Some of them
3 might have picked up on it. I don't know. You're
4 asking me what happens in the lab. And what happens
5 in the lab is they say, "This is a two-piece ball
6 patent," and they've got a new composition for a
7 cover.

8 Now, that doesn't mean that you could
9 not do the kind of close reading that we're doing
10 now. It just means, in answer to your question what
11 somebody would do who is ordinarily skilled in the
12 art and working in the lab, I think they'd look at
13 two-piece description and two-piece kind of claims
14 and they'd say, "These folks are trying to do a
15 blend. See if they can get -- if they contain the
16 urethane problem somehow to put a cover on."

17 Q. So it's your opinion that people of
18 ordinary skill in the art wouldn't pay much attention
19 to this reference to Nesbitt, for the most part?

20 A. I think that's true for the most part.
21 Reading this doesn't -- This patent doesn't read that
22 way. It reads like, "We don't know how to get a
23 urethane cover on there, so we've tried to find some
24 way of blending it so we can get control of the
25 manufacturability of the problem."

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1 Q. On page 22 of your report and the following
2 pages, you discuss whether the disclosure of Shore C
3 in the '751 patent inherently discloses a Shore D
4 hardness. Do you remember that discussion?

5 A. Do I remember what discussion? I'm sorry.
6 What I wrote or...

7 Q. Yes.

8 A. Oh, yes, um-hum.

9 Q. Is there any disclosure of a Shore C
10 hardness that would inherently be less than 64 on a
11 Shore D scale?

12 A. "Is there any disclosure of a Shore C
13 hardness that would inherently be less than 64 on a
14 Shore D?"

15 Q. That's right.

16 A. Gee, I don't know what that means.

17 Q. Let me see if I can rephrase it so it means
18 something to you.

19 A. Yes.

20 Q. In the '751 patent, you agree that there is
21 a disclosure of an outer cover hardness of 72 to 76
22 on a Shore C scale, right?

23 A. You're speaking of the table in Column 7
24 and 8?

25 Q. The table in -- specifically on Column 7,

EXHIBIT 5

US005554389A

United States Patent [19]
Badylak et al.[11] **Patent Number:** **5,554,389**
[45] **Date of Patent:** **Sep. 10, 1996**[54] **URINARY BLADDER SUBMUCOSA
DERIVED TISSUE GRAFT**[75] **Inventors:** Stephen F. Badylak, W. Lafayette;
Sherry L. Voytik, Lafayette; Andrew
Brightman, W. Lafayette; Matt
Waninger, Frankfort, all of Ind.[73] **Assignee:** Purdue Research Foundation, West
Lafayette, Ind.[21] **Appl. No.:** 418,763[22] **Filed:** Apr. 7, 1995[51] **Int. Cl.⁶** **A61K 35/22**[52] **U.S. Cl.** 424/558; 424/572; 623/1;
623/11; 623/12; 623/13; 623/14; 623/16;
623/18; 623/19; 623/20; 623/21[58] **Field of Search** 424/558, 572;
623/1, 11, 12, 13, 14, 16, 18, 19, 20, 21[56] **References Cited****U.S. PATENT DOCUMENTS**

4,902,508	2/1990	Badylak et al.	424/551
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5,352,463	10/1994	Badylak et al.	424/551
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Primary Examiner—John W. Rollins**Assistant Examiner**—Jean C. Witz**Attorney, Agent, or Firm**—Barnes & Thornburg[57] **ABSTRACT**

A tissue graft composition comprising bladder submucosal tissue delaminated from abluminal muscle layers and at least the luminal portion of the tunica mucosa of a segment of vertebrate urinary bladder is described. The graft composition can be implanted to replace or support damaged or diseased tissues.

10 Claims, No Drawings

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URINARY BLADDER SUBMUCOSA DERIVED TISSUE GRAFT

FIELD OF THE INVENTION

The present invention relates to a tissue graft composition and methods for its preparation and use. More particularly, the present invention is directed to non-immunogenic tissue graft compositions comprising urinary bladder submucosa and use of same to promote endogenous tissue growth.

BACKGROUND AND SUMMARY OF THE INVENTION

It is known that compositions comprising the tunica submucosa of the intestine of warm-blooded vertebrates can be used advantageously as tissue graft materials. See U.S. Pat. Nos. 4,902,508 and 5,281,422. The tissue graft compositions described in those patents are characterized by excellent mechanical properties, including high compliance, a high burst pressure point, and an effective porosity index which allows such compositions to be used beneficially for vascular graft and connective tissue graft constructs. When used in such applications the graft constructs appear not only to serve as a matrix for the regrowth of the tissues replaced by the graft constructs, but, indeed, to promote or induce such regrowth of endogenous tissue. Common events to this remodeling process include: widespread and very rapid neovascularization, proliferation of granulation mesenchymal cells, biodegradation/resorption of implanted intestinal submucosal tissue material, and lack of immune rejection.

It is also known that intestinal submucosa can be fluidized by comminuting and/or protease digestion, without loss of its apparent biotrophic properties, for use in less invasive methods of administration (e.g., by injection or topical application) to host tissues in need of repair. See U.S. Pat. No. 5,275,826.

There has been much additional research effort directed to finding other natural and synthetic materials having the requisite properties for use as tissue grafts. Surprisingly, it has been found that urinary bladder submucosa (UBS) prepared by delamination of bladder tissue of warm-blooded vertebrates exhibits mechanical and biotrophic properties similar to that which has been reported for intestinal submucosal tissue. It can be substituted for intestinal submucosa tissue in most, if not all, of the applications previously reported for intestinal submucosa.

The tissue graft composition of the present invention comprises urinary bladder submucosa derived from urinary bladder tissue of a warm-blooded vertebrate. The wall of the urinary bladder is composed of the following layers: the tunica mucosa (including a transitional epithelium layer and the tunica propria), a submucosa layer, up to three layers of muscle and the adventitia (a loose connective tissue layer)—listed in thickness crosssection from luminal to abluminal sides. Urinary bladder submucosa for use in accordance with the present invention is delaminated from the abluminal muscle layers and at least the luminal portion of the tunica mucosa of the urinary bladder tissue. The present graft composition can be implanted or injected into a vertebrate host to induce the repair or replacement of damaged or defective tissues.

DETAILED DESCRIPTION OF THE INVENTION

The tissue graft composition in accordance with the present invention comprises urinary bladder submucosa of a warm-blooded vertebrate delaminated from adjacent bladder

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tissue layers. The present tissue graft composition thus comprises the bladder submucosa delaminated from abluminal muscle cell layers and at least the luminal portion of the mucosal layer of a segment of urinary bladder of a warm-blooded vertebrate. Typically the delamination technique described below provides a tissue composition consisting essentially of urinary bladder submucosa. These compositions are referred to herein generically as urinary bladder submucosa (UBS).

UBS graft material is typically prepared from bladder tissue harvested from animals raised for meat production, including, for example, pigs, cattle and sheep or other warm-blooded vertebrates. Thus, there is an inexpensive commercial source of urinary bladder tissue for use in preparation of the tissue compositions in accordance with the present invention.

The preparation of UBS from a segment of urinary bladder is similar to the procedure for preparing intestinal submucosa detailed in U.S. Pat. No. 4,902,508, the disclosure of which is expressly incorporated herein by reference. A segment of urinary bladder tissue is first subjected to abrasion using a longitudinal wiping motion to remove both the outer layers (particularly the abluminal smooth muscle layers) and the luminal portions of the tunica mucosa layers—the epithelial layers). The resulting submucosa tissue has a thickness of about 80 micrometers, and consists primarily (greater than 98%) of a cellular, eosinophilic staining (H&E stain) extracellular matrix material. Occasional blood vessels and spindle cells consistent with fibrocytes are scattered randomly throughout the tissue. Typically the UBS is rinsed with saline and optionally stored in a frozen hydrated state until used as described below.

Fluidized UBS can be prepared in a manner similar to the preparation of fluidized intestinal submucosa, as described in U.S. Pat. No. 5,275,826 the disclosure of which is expressly incorporated herein by reference. The UBS is comminuted by tearing, cutting, grinding, shearing and the like. Grinding the UBS in a frozen or freeze-dried state is preferred although good results can be obtained as well by subjecting a suspension of submucosa pieces to treatment in a high speed (high shear) blender and dewatering, if necessary, by centrifuging and decanting excess water. Additionally, the comminuted fluidized tissue can be solubilized by enzymatic digestion of the bladder submucosa with a protease, such as trypsin or pepsin, or other appropriate enzymes for a period of time sufficient to solubilize said tissue and form a substantially homogeneous solution.

The present invention also contemplates the use of powder forms of UBS. In one embodiment a powder form of UBS is prepared by pulverizing urinary bladder submucosa tissue under liquid nitrogen to produce particles ranging in size from 0.1 to 1mm². The particulate composition is then lyophilized overnight and sterilized to form a solid substantially anhydrous particulate composite. Alternatively, a powder form of UBS can be formed from fluidized UBS by drying the suspensions or solutions of comminuted UBS.

The UBS tissue compositions of the present invention lend themselves to a wide variety of surgical applications relating to the repair or replacement of damaged tissues, including, for example the repair of vascular and connective tissues. Connective tissues for the purposes of the present invention includes bone, cartilage, muscle, tendons, ligaments, and fibrous tissue including the dermal layer of skin.

In accordance with the present invention, the graft compositions of the present invention are used advantageously to induce the formation of endogenous tissue at a desired site

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in a warm blooded vertebrate. Compositions comprising urinary bladder submucosa can be administered to a vertebrate host in an amount effective to induce endogenous tissue growth at a site in the host in need of same due to the presence of damaged or diseased tissue. The UBS compositions can be administered to the host in either solid or sheet form, by surgical implantation, or in fluidized form, by injection.

In one embodiment the present UBS compositions in sheet form can be used to form vascular grafts. The diameter of the graft should be about the same as the diameter of the recipient blood vessel. This is accomplished by manipulating the UBS to define a cylinder having diameter approximately the same as that of the recipient blood vessel and suturing or otherwise securing the tissue graft longitudinally to form said vascular graft. Thus, for example, a vascular graft can be prepared by selecting a sterile glass rod having an outer diameter equal to that of the recipient blood vessel, wrapping the UBS sheet around the glass rod and gathering the redundant tissue. The desired lumen diameter is achieved by suturing along the length of the graft (for example, using two continuous suture lines or a simple interrupted suture line) or by using other art-recognized tissue securing techniques. The vascular graft is surgically substituted for a damaged or diseased blood vessel using standard vascular surgery techniques.

Consistent with the use of UBS as a vascular graft material, UBS possesses mechanical properties highly desirable for such tissue graft materials, including low porosity index, high compliance, and a high burst pressure point. Those skilled in the art will appreciate that vascular graft material must be of low enough porosity to prevent intra-operative hemorrhage and yet of high enough porosity to allow extension of a newly-developed vasa vasorum through the graft material to nourish the luminal surface. Porosity of a graft material is typically measured in terms of ml of water passed per $\text{cm}^2 \text{min}^{-1}$ at a pressure of 120 mm Hg. UBS has a differential porosity to deionized water at 120 mm Hg pressure. The "porosity index" for UBS from the luminal toward abluminal direction is approximately 6.0; whereas the porosity index in the opposite direction is approximately 50. This property of differential porosity has also been noted for intestinal submucosal tissue but the values are an order of magnitude less than those values for UBS.

The UBS segments can also be used in accordance with this invention as a tissue graft construct for use in the repair or replacement of connective tissues using the same procedures described for use of intestinal submucosa in U.S. Pat. No. 5,281,422 and 5,352,463, expressly incorporated herein by reference. The UBS composition can be used in its delaminated natural sheet form or it can be cut longitudinally or laterally to form elongated tissue segments. Such segments or sheets have an intermediate portion, and opposite end portions and opposite lateral portions which can be formed for surgical attachment to existing physiological structures, using surgically acceptable techniques.

The grafts formed and used in accordance with this invention, upon implantation, undergo biological remodeling. They serve as a rapidly vascularized matrix for support and growth of new endogenous connective tissue. When used as a tissue graft material UBS has been found to be trophic for host tissues with which it is attached or otherwise associated in its implanted environment. The graft material has been found to be remodelled (resorbed and replaced with autogenous differentiated tissue) to assume the characterizing features of the tissue(s) with which it is associated at the site of implantation. In tendon and ligament replacement

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studies the graft appears to develop a surface that is synovialized. Additionally, the boundaries between the graft and endogenous tissue are no longer discernible. Indeed, where a single graft "sees" multiple microenvironments as implanted, it is differentially remodeled along its length. Thus, for example, when used in cruciate ligament replacement experiments, not only does the portion of the graft traversing the joint become vascularized and actually grow to look and function like the original ligament, but the portion of the graft in the femoral and tibial bone tunnels rapidly incorporates into and promotes development of the cortical and cancellous bone in those tunnels.

For tendon and ligament replacement applications, and other connective tissue repair applications UBS graft constructs are typically preconditioned by stretching longitudinally to a length longer than the length of the urinary bladder submucosa from which the graft construct was formed. One method of "pre-conditioning" involves application of a given load to the urinary bladder submucosa for three to five cycles. Each cycle consists of applying a load to the graft material for five seconds, followed by a ten second relaxation phase. Three to five cycles produces a stretch-conditioned graft material with reduced strain. The graft material does not return to its original size; it remains in a "stretched" dimension. For example, a UBS segment can be conditioned by suspending a weight from said segment, for a period of time sufficient to allow about 10 to about 20% or more elongation of the tissue segment. Optionally, the graft material can be preconditioned by stretching in the lateral dimension. The graft material exhibits similar viscoelastic properties in the longitudinal and lateral dimensions.

The graft segment is then formed in a variety of shapes and configurations, for example, to serve as a ligament or tendon replacement or a patch for a broken or severed tendon or ligament. Preferably, the segment is shaped and formed to have a layered or even a multilayered configuration with at least the opposite end portions and/or opposite lateral portions being formed to have multiple layers of the graft material to provide reinforcement for attachment to physiological structures, including bone, tendon, ligament, cartilage and muscle. In a ligament replacement application, opposite ends are attached using standard surgical technique to first and second bones, respectively, the bones typically being articulated as in the case of a knee joint.

The end portions of the UBS material can be formed, manipulated or shaped to be attached, for example, to a bone structure in a manner that will reduce the possibility of graft tearing at the point of attachment. Preferably the material can be folded or partially exerted to provide multiple layers for gripping, for example, with spiked washers or staples.

Alternatively, the UBS material may be folded back on itself to join the end portions to provide a first connective portion to be attached, for example, to a first bone and a bend in the intermediate portion to provide a second connective portion to be attached to a second bone articulated with respect to the first bone. For example, one of the end portions may be adapted to be pulled through a tunnel in, for example, the femur and attached thereto, while the other of the end portions may be adapted to be pulled through a tunnel in the tibia and attached thereto to provide a substitute for the natural cruciate ligament, the segment being adapted to be placed under tension between the tunnels to provide a ligament function, i.e., a tensioning and positioning function provided by a normal ligament.

The present UBS composition may be sterilized using conventional sterilization techniques including tanning with

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glutaraldehyde, formaldehyde tanning at acidic pH, ethylene oxide treatment, propylene oxide treatment, gas plasma sterilization, gamma radiation, and peracetic acid sterilization. A sterilization technique which does not significantly weaken the mechanical strength and biotropic properties of the graft is preferably used. For instance, it is believed that strong gamma radiation may cause loss of strength in the graft material. Because one of the most attractive features of these intestinal submucosa grafts is their ability to induce host-remodelling responses, it is desirable not to use a sterilization approach which will detract from that property. Preferred sterilization techniques include exposing the graft to peracetic acid, low dose gamma irradiation and gas plasma sterilization; peracetic acid sterilization being the most preferred method. Typically, after the tissue graft composition has been sterilized, the composition is wrapped in a porous plastic wrap and sterilized again using electron beam or gamma irradiation sterilization techniques.

We claim:

1. A composition comprising urinary bladder submucosa delaminated from both the abluminal muscle layers and at least the luminal portion of the tunica mucosa of a segment of a urinary bladder of a warm blooded vertebrate.
2. The composition of claim 1 wherein the urinary bladder submucosa is fluidized.
3. The composition of claim 1 wherein the urinary bladder submucosa is digested with a protease for a period of time sufficient to solubilize the tissue and provide a substantially homogenous solution.
4. The composition of claim 1, wherein the urinary bladder submucosa is dried and in powder form.

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5. The composition of claim 1 formed into a cylinder having a predetermined luminal diameter and sutured along the length of the cylinder.

6. The composition of claim 1 conditioned for use as a connective-tissue substitute by stretching to produce a graft construct longer than the segment of urinary bladder tissue from which it is formed.

7. A non-immunogenic tissue graft composition capable of inducing endogenous connective tissue growth when implanted in warm-blooded vertebrates, said composition comprising urinary bladder submucosa delaminated from both the abluminal muscle layers and at least the luminal portion of the tunica mucosa of a segment of a urinary bladder of a warm-blooded vertebrate.

8. A method for inducing the formation of endogenous connective tissue at a site in need of endogenous tissue growth in a warm blooded vertebrate, said method comprising transplanting a graft composition comprising urinary bladder submucosa in an amount effective to induce endogenous connective tissue growth at the site the composition is administered.

9. The method of claim 8, wherein the graft composition is fluidized and is administered by injection into the warm-blooded vertebrate.

10. The method of claim 8, wherein the graft composition is administered by surgically implanting the composition into the warm-blooded vertebrate.

* * * * *

EXHIBIT 6



US005813073A

United States Patent [19]

Korbonski

[11] Patent Number: 5,813,073

[45] Date of Patent: Sep. 29, 1998

[54] SHEET-CLEANING APPARATUS WITH CARTRIDGE ROLLER ASSEMBLY

[75] Inventor: John A. Korbonski, San Juan Capistrano, Calif.

[73] Assignee: Systems Division Incorporated, Irvine, Calif.

[21] Appl. No.: 722,857

[22] Filed: Sep. 26, 1996

[51] Int. Cl.⁶ B08B 11/00

[52] U.S. Cl. 15/3; 15/102; 15/256.52

[58] Field of Search 15/3, 100, 102, 15/256.52

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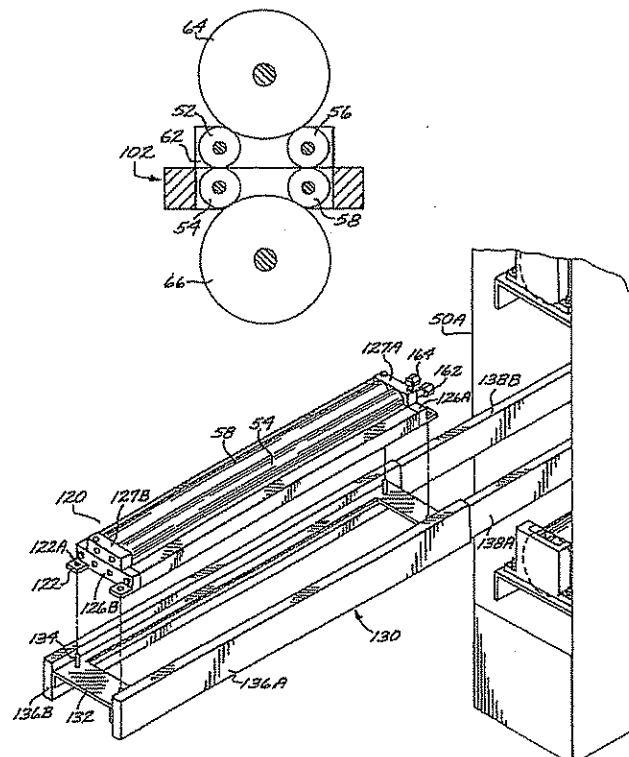
Primary Examiner—Mark Spisich

Attorney, Agent, or Firm—Larry K. Roberts

[57] ABSTRACT

A sheet cleaning apparatus having sets of cleaning rollers, wherein the rollers are integrated into a removable cartridge structure. Couplers are provided at roller shaft ends to connect to the roller drive. The cartridge is received in a slide carriage, permitting the cartridge to be readily removed from the apparatus by sliding the carriage out, and lifting the cartridge out from the slide carriage. With this arrangement, the down time for the sheet cleaning apparatus is minimized, since the sheet cleaning apparatus can be provided with two cartridges, and the cartridge needing maintenance can simply be quickly removed and replaced with a fresh cartridge. The production line can quickly be put back into operation, and the removed cartridge can be serviced off line for subsequent use.

16 Claims, 3 Drawing Sheets

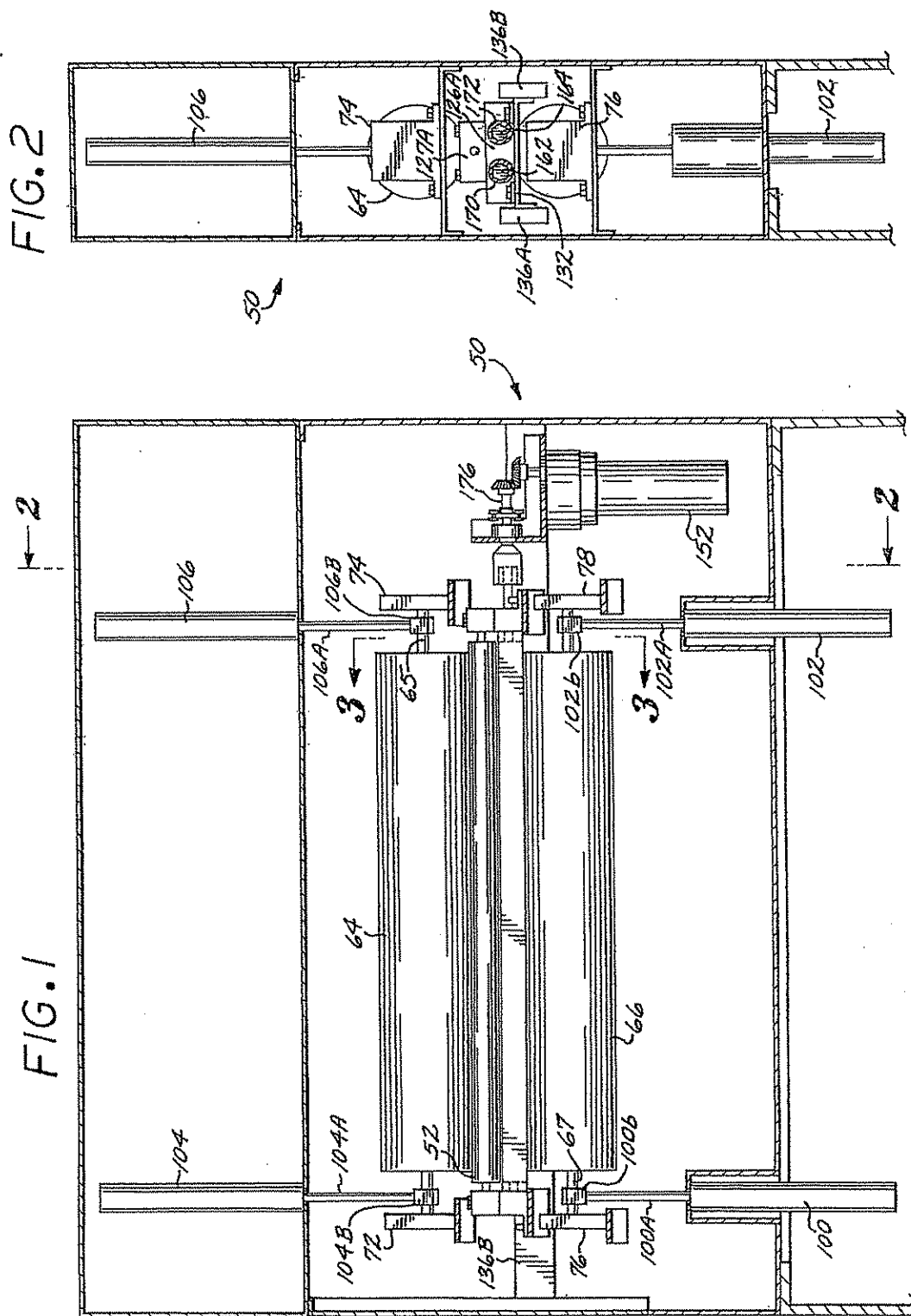


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FIG. 3

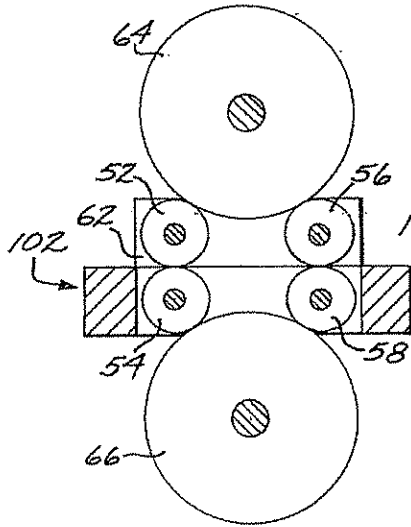


FIG. 4

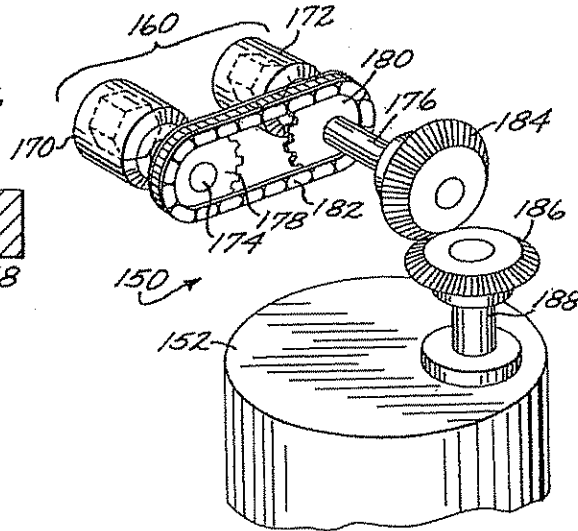
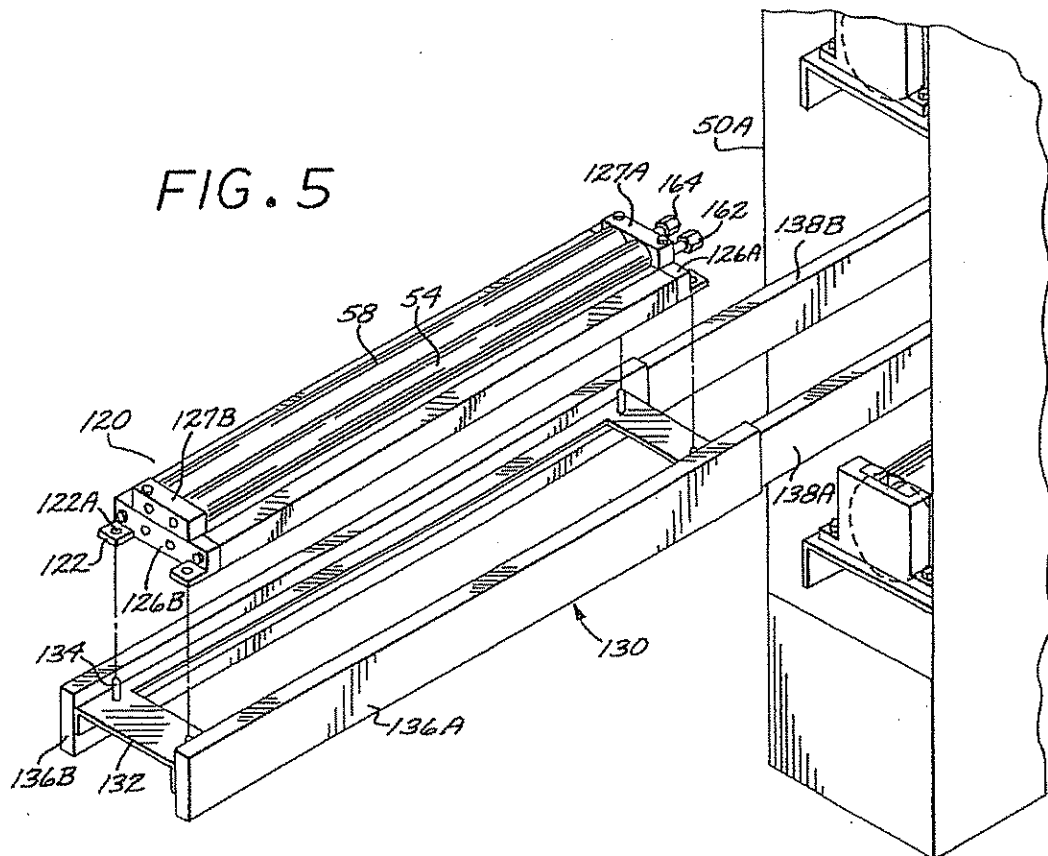


FIG. 5



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SHEET CLEANING-APPARATUS WITH CARTRIDGE ROLLER ASSEMBLY

TECHNICAL FIELD OF THE INVENTION

The present invention relates to an improved apparatus for cleaning dust and other surface particulate contaminants from material in sheet form.

BACKGROUND OF THE INVENTION

This invention is an improvement to the sheet cleaning apparatus described in U.S. Pat. No. 5,349,714, the entire contents of which are incorporated herein by reference. These apparatus are typically arranged in a printed circuit board production line, with other, very expensive machines. When the sheet cleaning apparatus needs servicing, typically to clean the sheet cleaning rollers (52, 54, 56, 58, shown e.g. in FIG. 8), the apparatus must be disassembled to remove the rollers, or the operator must clean the rollers in place. With either technique, considerable time is required for this maintenance procedure, idling not only the sheet cleaning apparatus but the other, very expensive machines on the production line.

It would therefore be advantageous to provide a sheet cleaning apparatus which can be quickly serviced to minimize the machine down time.

SUMMARY OF THE INVENTION

To overcome the foregoing problems, a sheet cleaning apparatus is described, having one or more sets of cleaning rollers, wherein the rollers are integrated into a removable cartridge assembly. Couplers are provided at roller shaft ends to connect to the roller drive. The cartridge assembly is held in a slide carriage, permitting the cartridge assembly to be readily removed from the apparatus by sliding the carriage out, and lifting the cartridge out from the slide carriage. With this arrangement, the down time for the sheet cleaning apparatus is minimized, since the sheet cleaning apparatus can be provided with two cartridges, and the cartridge needing maintenance can simply be quickly removed and replaced with a fresh cartridge. The production line can quickly be put back into operation, and the removed cartridge can be serviced off line for subsequent use.

BRIEF DESCRIPTION OF THE DRAWING

These and other features and advantages of the present invention will become more apparent from the following detailed description of an exemplary embodiment thereof, as illustrated in the accompanying drawings, in which:

FIG. 1 is a front view of a sheet cleaning apparatus embodying the invention.

FIG. 2 is a side cross-sectional view taken along line 2—2 of FIG. 1.

FIG. 3 is a side view illustrating the relative orientation of the sheet cleaning rollers and the roller cleaning adhesive rolls.

FIG. 4 is a simplified perspective view illustrating an exemplary motor/gear drive arrangement for driving the roller couplers.

FIG. 5 illustrates the sheet cleaning apparatus with the roller cartridge exposed and removed from the cartridge slide arrangement for replacement.

FIG. 6 is an exploded view of the drive end of the cartridge roller assembly.

FIG. 7 is an isometric view of a roller lifting device employing in the apparatus of FIG. 1 to bias the position of

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the upper set of sheet cleaning rollers upwardly for separation from the lower set of sheet cleaning rollers when the apparatus is not in use.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIGS. 1-7 illustrate an exemplary embodiment of a sheet cleaning apparatus 50 embodying the invention. The apparatus 50 includes two pairs of sheet-contacting cleaning rollers 52, 54 and 56, 58. Rollers 52 and 54 are disposed in vertical alignment adjacent each other to define a nip 62. The surfaces of the cleaning rollers 52, 54, 56, 58 are defined by a layer of resilient compressible material which has a surface tack or adhesion sufficient to transfer dust and other foreign particulate contamination from a sheet coming into compressive contact with the roller surface. It is also desirable that the roller surfaces be smooth, in order to obtain complete contact with the surface of a sheet pressed against the surface. Typically, the roller surfaces will have a Shore A durometer value of up to 35.

In order to clean the surfaces of the sheet cleaning rollers 52-58, rolls 64, 66 of adhesive-coated tape are provided. These rolls 64, 66 are disposed so as to be in contact with respective surfaces of rollers 52-58 during sheet cleaning operations, as shown in FIG. 3. In a general sense, the rolls 64, 66 are defined by rolls of tape having the adhesive coating on the outward facing sides. The external surface of each of the rolls 64, 66 has a surface tack which greatly exceeds the surface tack of the sheet cleaning rollers 52-58, in order to transfer the foreign particles from the sheet cleaning rollers 52-58 to the surfaces of rolls 64, 66.

To the extent just described, the apparatus 50 is similar to that described in U.S. Pat. No. 5,349,714.

The apparatus 50 includes a system for applying a variable preload force, urging roller 64 into engagement with surfaces of rollers 52 and 56, and urging roller 66 into engagement with surfaces of rollers 54 and 58. The system includes pneumatic cylinders 100 and 102 which support the lower tape roller 66, and pneumatic cylinders 104 and 106 which apply pressure to the upper tape roller 64. Cylinder 100 includes a rod 100A driven by a cylinder piston to an extended position. The rod is attached to a coupler 100B which has an opening into which an end of shaft 67 carrying roll 66 is inserted. Cylinder 102 includes rod 102A driven by a cylinder piston to an extended position. Rod 102A is attached to a coupler 102B which has an opening into which the opposed end of shaft 67 is inserted. The roll 66 is therefore supported by the system comprising cylinders 100 and 102 and couplers 100B and 102B. The cylinders 100 and 102 are single acting, spring biased devices, wherein the rods are spring biased to the fully retracted position, and the rods are extended against the bias when pneumatic pressure is applied to the cylinders. Further the compression contact force of the roll 66 in relation to the sheet cleaning rollers 54 and 58 is adjustable by adjusting the pneumatic pressure applied to the cylinders 100 and 102.

The system further includes pneumatic cylinders 104 and 106 which apply pressure to the upper tape roller 64. Cylinder 104 includes a rod 104A driven by a cylinder piston to an extended position. The rod is attached to a coupler 104B which has an U-shaped opening into which a portion of shaft 65 carrying roll 64 and adjacent a shaft end is received. Cylinder 106 includes rod 106A driven by a cylinder piston to an extended position. Rod 106A is attached to a coupler 106B which has an opening into which a portion of shaft 67 adjacent the opposite end of the shaft

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is received. The cylinders 104 and 106 are single acting, spring biased devices, wherein the rods are spring biased to the fully retracted position, and the rods are extended against the bias when pneumatic pressure is applied to the cylinders. Further the compression contact force of the roll 64 in relation to the sheet cleaning rollers 52 and 56 is adjustable by adjusting the pneumatic pressure applied to the cylinders 104 and 106.

The shaft 65 is carried by spring-loaded bracket assemblies 72 and 74. Exemplary bracket assembly 72 is illustrated in FIG. 7, and includes outer bracket fixture 72A, sliding bracket 72B which fits within the outer fixture for sliding movement, and bias spring elements 72D and 72E. The spring elements bias the relative position of the sliding bracket 72B to the upper position shown in FIG. 7, and upon application of force, the springs are compressible to permit the bracket 72B to slide down. Assembly 74 is identical to assembly 72. Together, these assemblies bias the upper tape roll 64 to an elevated position out of contact with the cleaner rollers 52, 56 when the machine is idle, i.e. when the pneumatic pressure for the cylinders 104 and 106 is released. This prevents the tape roll surface from adhering to the cleaner roller as a result of extended stationary contact. When the pneumatic pressure is removed from the cylinders 100, 102, the lower tape roll 66 drops by force of gravity out of contact with the lower set of cleaner rollers 54, 58, and is supported by a V-shaped cradle in brackets 76, 78. No spring biasing is employed in connection with brackets 76, 78, since such biasing would tend to keep the tape roll surface in contact with the surfaces of the lower cleaner rollers after the pneumatic pressure is released.

In accordance with an aspect of the invention, the cleaner rollers are arranged in an easily removable cartridge assembly 120. The assembly 120 is mounted on a slide assembly 130 which permits the cartridge assembly to be moved from a working position, with the cleaner rollers in position within the apparatus 50 for operation, and a maintenance position (shown in FIG. 5) with the cleaner rollers and the cartridge assembly slid outside the housing 50A of the cleaner apparatus 50 for ready replacement of the cartridge 120.

As shown in FIG. 5, the slide assembly 130 includes a carriage member 132 which receives the cartridge assembly 120. Four mounting tabs 122 on the carriage assembly have holes 122A formed therein. The cartridge assembly 120 is dropped and locked into position on the carriage 132, with pins 134 extending upwardly from the carriage 132 and received through holes 122A registering the position of the cartridge 120 on the carriage 132. The cartridge assembly is locked into position by spring-loaded locking tabs (not shown) formed with the pins 134, which locking tabs spring out after cartridge assembly has dropped onto the pins to lock the cartridge in position. This prevents the cartridge from being lifted from the carriage by the tackiness of the roll 64 as pressure is released from the pneumatic system. Other types of locking arrangements can readily be employed. The carriage 132 is mounted between a first set of opposed slide rails 136A, 136B, which in turn are mounted on a second set of opposed slide rails 138A, 138B. The second set of rails 138A, 138B are mounted on bearings (not shown) mounted to the housing 50A to permit the second set of rails to slide outwardly also. The first set of rails is mounted on bearings to permit telescoping of the first and second sets of rails. The slide rails and bearings are parts of a commercially available slide assembly, such as the three-section linear drawer slides marketed by Jonathan Company, Fullerton, Calif., which lock in both the closed and open positions.

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The cartridge assembly 120 is shown in further detail in FIG. 6. Side rails 124A, 124B and end rails 126A, 126B form a carriage structure which carries the lower set of cleaner rollers 54, 58. The rollers rotate on respective shafts 54A, 58A which in turn are mounted on bearings fitted in openings formed in the end rails. For example, bearings 126AA and 126AB are mounted in end rail 126A. Only the drive end of the carriage assembly 120 is visible in FIG. 5. The lower set of rollers are driven by a motor drive 150 (FIGS. 1 and 4) through a drive coupler 160. The roller shafts 54A, 58A have flats 54AA, 58AA formed adjacent the shaft ends to form D-shaped shaft ends for mating with corresponding D-shaped openings 162A, 164A formed in hexagonal male coupler elements 162, 164 to prevent rotation of the coupler elements on the shafts, while permitting axial sliding movement of the coupler elements on the shafts. Springs 166A, 166B are fitted on the shafts and extend between an end surface of rail 126A and the coupler elements 162 and 164 to urge the coupler elements away from the end surface of rail 126A. Snap rings 168A, 168B lock into position in grooves 54AB and 58AB to lock the coupler elements 162, 164 onto the shafts, after assembly of the springs 166A, 166B and the coupler elements onto the shafts. The coupler elements 162, 164 are formed with conical end surfaces 162B, 164B which act as lead-in surfaces to align the male hexagonal coupler elements with corresponding female driven hexagonal coupler elements 170, 172 shown in the isolation perspective view of FIG. 4. The driven coupler elements are mounted on shafts 174, 176. Sprocket gears 178, 180 are mounted on the respective shafts 174, 176, and have an endless chain 182 mounted thereon. The shaft 176 also has a beveled gear 184 mounted thereon, which meshes with beveled gear 186 mounted on the motor shaft 188. The cleaner rollers 54, 58 are driven in the same direction by the motor drive 150.

The upper cleaner rollers 52, 56 are not actively driven. Referring again to FIG. 6, the upper rollers are mounted to the cartridge assembly 120 by upper end rails 127A, 127B. The roller shafts 52A, 56A are received in corresponding bores (e.g. 127AA, 127AB) formed in the upper end rails. The upper end rails are slidably mounted on pins 128A, 128B which are received in bores (e.g. bores 127AC, 127AD) formed in the upper end rails. Springs (e.g., springs 129A, 129B) can be fitted on the pins to provide a bias force tending to separate the upper end rails 127A, 127B from the lower end rails 126A, 126B. This in turn biases the upper set of cleaner rollers 52, 56 away from the lower set of rollers 54, 58. The upper set of pneumatic cylinders 104, 106 can exert a force on the tape roll 64 to push the upper set of rollers toward the lower set of rollers. The bias action of the springs, biasing the upper set of rollers away from the lower rollers and therefor tending to increase the nip gap, provides the advantage of facilitating the cleaning of thicker sheets for cleaning without adjusting the apparatus. For some applications, it is preferable to omit the springs fitted on the pins.

The cleaning apparatus employs a pneumatic supply and control system similar to that described in U.S. Pat. No. 5,349,714, and illustrated at FIG. 9. Similarly, the control circuit of FIG. 10 in U.S. Pat. No. 5,349,714 can be employed to control the motor drive 150. The pneumatic supply and control system and the motor drive control circuit therefore need not be described in further detail herein.

The cartridge assembly 120 can easily be replaced with a fresh cartridge. This can be done by releasing the pressure on the pneumatic cylinders 100-106, so that the tape rolls move

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out of engagement with the cleaner rollers 52-58. The latch of the slide assembly is then released, and the carriage 132 is pulled from the operating position to the maintenance position shown in FIG. 5. As the carriage is pulled out away from its operating position, the drive coupler elements 162, 164 become disengaged from the mating coupler elements 170, 172, thereby disconnecting the cartridge from the motor drive 150. The cartridge 120 is then removed, without the use of tools in this exemplary embodiment, by lifting the assembly up and out of engagement with the pins 134. Once the cartridge assembly 120 is removed from the carriage 132, it can quickly be replaced by a fresh cartridge with clean sets of rollers 52-58. Once a fresh cartridge is positioned in the carriage 132, the operator slides the carriage into the operating position. As the carriage slides into position, the coupler elements 162, 164 are received within the coupler elements 170, 172. There may be some initial rotational misalignment between the hexagonal mating elements. If so, the springs 166A, 166B compress as the elements 162, 164 are pushed toward the end rail 126A. The conical surfaces 162B, 164B tend to align the mating elements by acting as a lead-in surface. Even if the mating elements do not engage as the cartridge is slid into the operating position, the first time the motor drive is actuated, as the outer coupler elements 170, 172 are turned by the motor drive, the mating elements will come into alignment, and the springs 166A, 166B will urge the elements 162, 164 into an engaged aligned position relative to the outer mating elements 170, 172.

The sheet cleaning apparatus can be quickly serviced by replacement of the cartridge assembly 120, thus minimizing the machine down time. The removed cartridge assembly 120 can be serviced off line. The upper set of rollers 52, 56 can easily be removed from the cartridge assembly for cleaning, and to expose the lower set of rollers for cleaning.

It is understood that the above-described embodiments are merely illustrative of the possible specific embodiments which may represent principles of the present invention. Other arrangements may readily be devised in accordance with these principles by those skilled in the art without departing from the scope and spirit of the invention.

What is claimed is:

1. A sheet cleaning apparatus for cleaning foreign particles from at least one surface of a sheet, comprising:

a frame;

a removable sheet cleaning roller cartridge assembly including at least one sheet cleaning roller rotatably secured thereto for rotation about a sheet cleaning roller axis, said roller comprising a layer of resilient material defining a peripheral roller surface with a high surface tack adapted to transfer foreign particles from said sheet to said peripheral roller surface upon contact and subsequent separation therebetween while affording clean separation between the sheet and said peripheral surface;

a roller cleaning member having a contact surface with a greater surface tack with respect to said foreign particles than said sheet cleaning roller surface, said contact surface adapted to transfer said foreign particles from said peripheral surface of said cleaning roller to said contact surface of said roller cleaning member during sheet cleaning operations, said roller cleaning member having an external surface defining said contact surface and a cleaning element axis arranged substantially parallel to said roller axis;

mounting apparatus for mounting said roller cartridge assembly in relation to said frame, said mounting

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apparatus permitting ready removal and replacement of said roller cartridge assembly with another roller cartridge assembly to minimize down time of said sheet cleaning apparatus while permitting off-line servicing of said removed roller cartridge assembly.

2. The apparatus of claim 1 wherein said mounting apparatus is adapted to permit movement of said roller cartridge assembly between an operating position in an apparatus operating mode wherein the sheet cleaning roller is in position for sheet cleaning operation and a maintenance position during an apparatus maintenance mode wherein said cartridge assembly is accessible for servicing.

3. The apparatus of claim 2 wherein said mounting apparatus includes a cartridge carriage and a slide apparatus to which said carriage is mounted, said slide apparatus adapted to permit sliding movement of said cartridge carriage along a slide axis parallel to said roller axis between said operating position and said maintenance position.

4. The apparatus of claim 3 wherein said carriage includes cartridge position registration elements for registering said cartridge in a cartridge position on said carriage.

5. The apparatus of claim 3 further comprising a drive apparatus for applying a rotational drive to said sheet cleaning roller, said drive apparatus including a drive coupler for selectively connecting said cleaning roller to said drive apparatus when said cartridge is in said operating position, and for disconnecting said cleaning roller from said drive apparatus when said cartridge is in said maintenance position.

6. The apparatus of claim 5 wherein said drive apparatus includes an electric motor for providing a source of rotational energy, and said coupler includes mating quick connect/disconnect elements which are connected when the carriage is in the operating position, and which are disconnected when the carriage is in the maintenance position.

7. A sheet cleaning apparatus for cleaning foreign particles from first and second opposed surfaces of a sheet, comprising:

a frame;

a removable sheet cleaning roller cartridge assembly including a first pair of sheet cleaning rollers, said first pair comprising first and second sheet cleaning rollers rotatably mounted for rotation about first and second sheet cleaning roller axes, each roller comprising a layer of resilient material defining a peripheral roller surface with a high surface tack adapted to transfer foreign particles from said sheet to said peripheral roller surface upon contact and subsequent separation therebetween while affording clean separation between the sheet and said peripheral surface, said first and second rollers disposed adjacent each other with said axes disposed in parallel to receive therebetween a sheet having said surfaces to be cleaned;

first and second roller cleaning members respectively disposed adjacent said first and second sheet cleaning rollers, each sheet cleaning member having a contact surface with a greater surface tack with respect to said foreign particles than said sheet cleaning roller surface, said contact surface adapted to transfer said foreign particles from said peripheral surface of said cleaning rollers to said contact surface of said roller cleaning member, said roller cleaning member having an external surface defining said contact surface and a cleaning element axis arranged substantially parallel to said respective roller axes;

mounting apparatus for mounting said roller cartridge assembly in relation to said frame, said mounting

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apparatus permitting ready removal and replacement of said roller cartridge assembly with another roller cartridge assembly to minimize down time of said sheet cleaning apparatus while permitting off-line servicing of said removed roller cartridge assembly.

8. The apparatus of claim 7 wherein said mounting apparatus is adapted to permit movement of said roller cartridge assembly between an operating position in an apparatus operating mode wherein each sheet cleaning roller is in position for sheet cleaning operation and a maintenance position during an apparatus maintenance mode wherein said cartridge assembly is accessible for servicing.

9. The apparatus of claim 8 wherein said mounting apparatus includes a cartridge carriage and a slide apparatus to which said carriage is mounted, said slide apparatus adapted to permit sliding movement of said cartridge carriage along a slide axis parallel to said roller axes.

10. The apparatus of claim 9 wherein said carriage includes cartridge position registration elements for registering said cartridge in a cartridge position on said carriage.

11. The apparatus of claim 9 further comprising a drive apparatus for applying a rotational drive to said first sheet cleaning rollers, said drive apparatus including a drive coupler for selectively connecting said first sheet cleaning rollers to said drive apparatus when said cartridge is in said operating position, and for disconnecting said first sheet cleaning rollers from said drive apparatus when said cartridge is in said maintenance position.

12. The apparatus of claim 11 wherein said drive apparatus includes an electric motor for providing a source of rotational energy, and said coupler includes mating quick connect/disconnect elements which are connected when the carriage is in the operating position, and which are disconnected when the carriage is in the maintenance position.

13. The apparatus of claim 7, wherein said cartridge assembly further includes a second pair of sheet cleaning rollers, said second pair comprising third and fourth sheet cleaning rollers rotatably mounted for rotation about third and fourth sheet cleaning roller axes, each roller of said second pair comprising a layer of resilient material defining a peripheral roller surface with a high surface tack adapted to transfer foreign particles from said sheet to said peripheral roller surface upon contact and subsequent separation therebetween, said third and fourth rollers disposed adjacent

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each other with said axes disposed in parallel to receive therebetween a sheet having said surfaces to be cleaned, said first pair disposed adjacent said second pair.

14. The apparatus of claim 7, wherein said cartridge assembly further comprises biasing apparatus for biasing the first and second sheet cleaning rollers apart in the absence of a loading force to facilitate cleaning a relatively thick sheet.

15. The apparatus of claim 14 wherein said biasing apparatus includes a pair of spring members arranged at respective ends of roller support end rails.

16. A sheet cleaning apparatus for cleaning foreign particles from at least one surface of a sheet, comprising:

a frame;

first and second removable sheet cleaning roller cartridge assemblies, each said assembly including at least one sheet cleaning roller rotatably secured thereto for rotation about a sheet cleaning roller axis, said roller comprising a layer of resilient material defining a peripheral roller surface with a high surface tack adapted to transfer foreign particles from said sheet to said peripheral roller surface upon contact and subsequent separation therebetween while affording clean separation between the sheet and said peripheral surface;

a roller cleaning member associated with one of said roller cartridge assemblies having a contact surface with a greater surface tack with respect to said foreign particles than said sheet cleaning roller surface, said contact surface adapted to transfer said foreign particles from said peripheral surface of said cleaning roller to said contact surface of said roller cleaning member during sheet cleaning operations, said roller cleaning member having an external surface defining said contact surface and a cleaning element axis arranged substantially parallel to said roller axis;

mounting apparatus for mounting said first roller cartridge assembly in relation to said frame, said mounting apparatus permitting ready removal and replacement of said roller cartridge assembly with said second roller cartridge assembly to minimize down time of said sheet cleaning apparatus while permitting off-line servicing of said removed first roller cartridge assembly.

* * * * *

EXHIBIT 7

6/27/78

OR 4,097,127

United States Patent [19]

[11] 4,097,127

Haas et al.

[45] Jun. 27, 1978

[54] **MIXED LIQUID CRYSTALLINE TEXTURE FORMATION**

[25] Inventors: Werner E. L. Haas, Webster; Gary A. Dir, Fairport, both of N.Y.

[73] Assignee: Xerox Corporation, Stamford, Conn.

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[51] Int. Cl.² G02F 1/13

[52] U.S. Cl. 350/332; 350/346

[58] Field of Search 350/150, 160 LC

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Primary Examiner—Edward S. Bauer

[57]

ABSTRACT

A mixture of the Grandjean texture and the focal-conic texture of the cholesteric mesophase is created by applying an electrical field to a liquid crystalline material in either the focal-conic or Grandjean texture of the cholesteric mesophase of a magnitude sufficient to transform the liquid crystalline material from the cholesteric mesophase to the nematic mesophase; and, decreasing the magnitude of said electrical field over a period of time effective to transform the liquid crystalline material from the nematic mesophase to a mixture of the Grandjean and focal-conic textures of the cholesteric mesophase.

6 Claims, No Drawings

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MIXED LIQUID CRYSTALLINE TEXTURE FORMATION

BACKGROUND OF THE INVENTION

This invention relates to the transformation of liquid crystalline materials; and, more particularly, to the formation of a mixed Grandjean and focal-conic texture of the cholesteric mesophase.

Many chemical compounds and mixtures have been found to exhibit physical characteristics some of which are typically associated with liquids and others which are typically unique to solid crystals. Liquid crystalline substances typically exhibit the mechanical characteristics, such as viscosities, which are ordinarily associated with liquids. In addition, the optical scattering and transmission characteristics of liquid crystalline substances are similar to those characteristics which are typically unique to solid crystals. Because of these similarities to both the liquid and crystalline forms of matter, the name "liquid crystals" has become generic to substances exhibiting these dual properties.

The molecular structure of liquid crystals helps to explain their dual characteristics. In liquid or fluid substances, the molecules are typically randomly distributed and oriented throughout the mass. Conversely, in crystalline solids the molecules are typically rigidly oriented and arranged in a specific crystalline structure. Liquid crystals resemble solid crystals in that the molecules of the liquid crystalline substance are regularly oriented in a fashion analogous to but less extensive than the molecular orientation and structure in a crystalline solid. It has been observed that many substances exhibit liquid crystalline characteristics only in a relatively narrow temperature range; below this temperature range the substances appear only as crystalline solids, and above the temperature range they appear only as liquids. Liquid crystals are known to appear in at least three different forms: the smectic, nematic, and cholesteric forms. These structural forms are sometimes referred to as mesophases, thereby indicating that they are states of matter intermediate between the liquid and crystalline states.

In the smectic structure the molecules are arranged in layers with their major axes approximately parallel to each other and approximately normal to the planes of said layers. Within a given layer the molecules may be organized in uniform rows, or randomly distributed throughout the layer, but in either case the major axes are still approximately normal to the plane of the layer. The attractive forces between layers are relatively weak so that the layers are free to move in relation to each other, thereby providing the smectic liquid crystalline substance with the mechanical properties of a planar or two-dimensional, soap-like fluid.

In the nematic structure, the major axes of the molecules lie approximately parallel to each other, but the molecules are not organized into definite layers as in the smectic structure.

In the cholesteric structure, the molecules are believed to be arranged in definite layers as in the smectic structure; however, within a given layer, the molecules are believed to be arranged with their major axes approximately parallel in a fashion resembling the structure of nematic liquid crystals. Because the major axes of the molecules in the cholesteric structure are believed to be parallel to the planes of the layers, the molecular layers are very thin. The cholesteric liquid

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crystalline structure typically have molecules which are derivatives of cholesterol or which are shaped very similarly to molecules of cholesterol. Because of the shape of the cholesteric molecule, in the cholesteric structure the direction of the major axes of the molecules in each of the aforementioned thin layers is displaced slightly from the direction of the major molecular axes in the adjacent molecular layers. When compared to a hypothetical straight line axis passing through a cholesteric liquid crystalline substance and perpendicular to the molecular planes within said substance, the angular displacement of the direction of the molecular axes within each adjacent molecular layer traces out a helical path around the hypothetical straight line axis.

Cholesteric liquid crystals are known to exhibit various observable textures. For example, cholesteric liquid crystals may adopt a homeotropic, a focal-conic, or a Grandjean plane texture as modifications of the cholesteric mesophase itself, as described, for example, in Gray G. W., "Molecular Structure in the Properties of Liquid Crystals", Academic Press, London, 1962, pages 39-54. The application of an electric field to a liquid crystalline material in the Grandjean texture of the cholesteric mesophase to transform the material from the Grandjean texture to the focal-conic texture of the cholesteric mesophase is known. See, for example, U.S. Pat. No. 3,704,056 to Wysocki et al.

The application of an electrical field to a liquid crystalline material in the cholesteric mesophase to transform the material from the cholesteric mesophase to the nematic mesophase is known. See, for example, U.S. Pat. No. 3,652,148.

Phase transforming a liquid crystalline material from the Grandjean texture of the cholesteric mesophase to the homeotropic texture of the nematic mesophase by an applied electrical field and then abruptly switching off the applied electrical field to cause reversion of the liquid crystalline material from the nematic mesophase to the Grandjean texture of the cholesteric mesophase is reported in "Electric Field Induced Texture Changes in Certain Nematic/Cholesteric Liquid Crystal Mixtures", W. Greubel et al., Vol. 24, Molecular Crystals and Liquid Crystals, pages 103-111, 1973. Therein, it is also reported on page 105 that if the liquid crystalline material is only partly brought into the electrical field induced nematic mesophase by increasing the field very slowly, then upon abruptly switching off the applied electrical field, only the areas with nematic alignment will return to the planar (Grandjean) texture. The other parts of the initially Grandjean texture which were not transformed into the nematic mesophase by the slowly applied electrical field shows the focal-conic texture of the cholesteric mesophase.

We have now discovered that a liquid crystalline material transformed by an applied electrical field into the nematic mesophase from either the focal-conic or Grandjean texture of the cholesteric mesophase can be transformed into a mixture of the focal-conic texture and the Grandjean texture of the cholesteric mesophase by decreasing the amplitude of the applied electrical field over a period of time effective to form the mixture. This discovery differs from that reported in the Greubel et al. article. In that article their end result of focal-conic region and Grandjean texture region as reported on page 105 of the article is not a mixture of two textures but two regions of different textures which come from two sources: the focal-conic texture comes from

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the initially Grandjean texture which did not transform into the nematic mesophase during slow application of the electrical field; and, the Grandjean texture in the mixture comes from the portion of the liquid crystalline material which did transform into the nematic mesophase. These two regional textures are formed by abruptly switching off the applied electrical field. On the other hand, our discovery is that liquid crystalline material initially in either the focal-conic or Grandjean texture of the cholesteric mesophase and transformed into the nematic mesophase can be transformed from the nematic mesophase into a mixture of the focal-conic and Grandjean textures of the cholesteric mesophase by a controlled decrease of the magnitude of the applied electrical field. Only the regions transformed into the nematic mesophase are transformed into the focal-conic and Grandjean texture mixture. The regions of the Grandjean or focal-conic texture of the initial cholesteric mesophase which were not transformed into the nematic mesophase remain in their initial focal-conic or Grandjean texture.

SUMMARY OF THE INVENTION

It is, therefore, an object of this invention to provide a novel method for forming a mixture of the Grandjean and focal-conic textures of the cholesteric mesophase.

It is a further object of this invention to provide a method of forming a mixture of the Grandjean and focal-conic textures of the cholesteric mesophase from a liquid crystalline material in the nematic mesophase.

These and other objects of the present invention are provided in accordance with the practice of the present invention by applying an electrical field to a liquid crystalline material in either the Grandjean or focal-conic texture of the cholesteric mesophase, the applied electrical field being within the cholesteric to nematic electrical field range of said liquid crystalline material, to transform the liquid crystalline material into the nematic mesophase; and then decreasing the magnitude of the applied electrical field over a period of time effective to transform the liquid crystalline material from the nematic mesophase to the mixture of the Grandjean and focal-conic textures of the cholesteric mesophase. Typical suitable times for field removal range from about 10 to about 200 milli-seconds.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The first portion of the practice of the present invention, i.e., applying an electrical field to a liquid crystalline material in either the Grandjean or focal-conic texture of the cholesteric mesophase to transform the material into the nematic mesophase, the applied electrical field being within the cholesteric to nematic electrical field range of said liquid crystalline material, is amply described in U.S. Pat. No. 3,652,148, hereby expressly incorporated by reference. While that patent is generically directed to the broader invention of transforming an optically negative liquid crystalline material into an optically positive liquid crystalline material by applying an electrical field across the material, the lists of liquid crystalline materials and mixtures thereof, the description of cell fabrication, the electrical field strengths required for phase transformation, etc., are described in detail in U.S. Pat. No. 3,652,148. These need not be elaborated upon herein. Furthermore, a whole host of liquid crystalline materials and mixtures thereof typically suitable for providing a liquid crystal-

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line material in the Grandjean or focal-conic textures of the cholesteric mesophase are listed in U.S. Pat. Nos. 3,704,056 and 3,680,950 hereby expressly incorporated by reference. Other typical suitable liquid crystalline materials in the Grandjean texture of the cholesteric mesophase comprise: a mixture of about 1 part by weight cholesteryl oleyl carbonate and about 2 parts by weight p'-pentyl-p-cyanobiphenyl; methoxybenzylidene-butylaniline (MBBA); about 10 parts by weight TN-100 (Hoffmann LaRoche) and about 4 parts by weight cholesteryl oleyl carbonate and about 95% by weight K15 (4-cyano-4'-n-pentyl biphenyl) and about 5% by weight cholesterol chloride.

Once the Grandjean or focal-conic texture of the cholesteric mesophase has been transformed into the nematic mesophase by an application of an electrical field within the cholesteric-to-nematic electrical field range of the liquid crystalline material, the magnitude of the applied electrical field is decreased over a period of time effective to transform the liquid crystalline material from the nematic mesophase into the mixture of the Grandjean and focal-conic textures of the cholesteric mesophase. The period of time is greater than an abrupt switching off of the applied electrical field and less than the electrical field removal time period for the liquid crystalline material to become completely focal-conic. That is, we have discovered that if the applied electrical field amplitude is decreased over a sufficiently long period of time, greater than about 200 milli-seconds the liquid crystalline material in the nematic mesophase will transform completely into the focal-conic texture of the cholesteric mesophase. The aforementioned Greubel et al. article reports that the abrupt switching off of the applied electrical field causes the nematic mesophase to transform completely into the Grandjean texture of the cholesteric mesophase. Thus, the period of time over which the applied electrical field is to be reduced in accordance with the practice of the present invention in order to achieve a transformation from the nematic mesophase into a mixture of the Grandjean texture and focal-conic texture of cholesteric mesophase, is in-between the abrupt turn off of Greubel et al. and the very slow turn off resulting in the complete transformation from nematic mesophase to focal-conic texture of the cholesteric mesophase.

This period of time to be utilized in decreasing the applied electrical field in accordance with the practice of the present invention, varies from material to material. However, utilizing our reported discovery, one skilled in the art can readily find the appropriate period of time with which to practice the present invention for any given material simply by phase transforming a liquid crystalline material from the Grandjean texture of the cholesteric mesophase into the nematic mesophase by applying an electrical field within the cholesteric-to-nematic electrical field range of the liquid crystalline material; and, then, decreasing the magnitude of the applied electrical field over various periods of time at least two of which do not result in a mixture of the Grandjean and focal-conic textures, one of the two period of times yielding complete transformation into the Grandjean texture of the cholesteric mesophase and the other period of time resulting in the complete transformation into the focal-conic texture of the cholesteric mesophase. Then, one skilled in the art should readily appreciate that the period of time over which the applied electrical field is to be decreased in accordance with the practice of this invention is one lying between

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these two extremes. A typically suitable range is from about 10 to about 200 milli-seconds. Furthermore, the period of time to be utilized can be varied between these two extremes to obtain varying relative amounts of the Grandjean and focal-conic textures in the mixture. At the lower range of the time period between these two extremes, the Grandjean texture predominates; whereas, at the upper range of the time period between these two extremes, the focal-conic texture predominates.

Variations in the relative amounts of each texture in the mixture of Grandjean and focal-conic textures will result in variations in brightness and contrast of the resulting image. The various electro-optic cells used for imaging in U.S. Pat. No. 3,652,148 can be employed in the practice of the present invention to provide photoconductor address, electron beam address, X-Y matrix address, shaped electrode address, shaped liquid crystalline layer imaging, etc. Enhanced brightness and contrast in imaging is provided by selectively varying the relative amounts of Grandjean and focal-conic textures in the mixture resulting from the practice of the present invention.

The following examples further specifically define the present invention with respect to forming a mixture of the Grandjean and focal-conic textures. The parts and percentages are by weight unless otherwise indicated. The examples below are intended to illustrate various preferred embodiments of the present invention.

EXAMPLE I

A mixture of about 95% by weight K15 (4-cyano-4'-n-pentyl biphenyl) available from British Drug House and about 5% by weight cholesterol chloride is placed at a thickness of about 10 microns between two electrodes. Each electrode comprises a glass slide overcoated with a layer of indium oxide over which silicon monoxide is deposited in accordance with the Janning technique. This technique is reported in "Thin Film Surface Orientation For Liquid Crystals", J. Appl. Phys. Letter, Vol. 21, No. 4, August 15, 1972. This silicon monoxide is deposited at an angle of 60° from the normal to the glass slide.

The cholesteric to nematic transition voltage threshold for the mixture used is about 10 volts. This voltage is applied between the two electrodes and the initially Grandjean texture of the cholesteric mesophase is transformed into the nematic mesophase. The entire layer of liquid crystalline material is transformed into the nematic mesophase.

The applied voltage of about 10 volts is decreased in magnitude to about 0 within a time period of about 1 micro-second. The entire layer of liquid crystalline material assumes the Grandjean texture of the cholesteric mesophase. The applied voltage of about 10 volts is decreased in magnitude to about 0 over periods of time varying up to about 10 micro-seconds. In each case, the entire layer of liquid crystalline material assumes the Grandjean texture.

The applied voltage of about 10 volts is decreased in amplitude to about 0 volts over various time periods ranging from about 10 milli-seconds to about 200 milli-seconds. The entire liquid crystalline layer becomes a mixture of the Grandjean and focal-conic textures of the cholesteric mesophase.

The applied voltage of about 10 volts is reduced in amplitude to about 0 over varying time periods greater

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than about 200 milli-seconds. In each case, the entire liquid crystalline layer assumes the focal-conic texture of the cholesteric mesophase.

EXAMPLE II

Example I is repeated except that the indium oxide coatings on the glass slides are shaped in the form of a letter "X".

When the applied about 10 volts is decreased in magnitude over a period of time between about 10 to about 200 milli-seconds, the region of the liquid crystalline layer corresponding to the shaped electrodes in the form of a "X" is a mixture of the focal-conic and Grandjean textures of the cholesteric mesophase. The "Background" region of the liquid crystalline layer, i.e. that region of the layer outside the boundaries of the shaped electrodes exhibits the Grandjean texture of the cholesteric mesophase.

When the applied voltage of about 10 volts is decreased in magnitude to about 0 over a time period varying from about 1 to about 10 micro-seconds, the entire layer of liquid crystalline material, including that corresponding to the shaped electrodes, exhibits the Grandjean texture.

When the applied about 10 volts is decreased in magnitude to about 0 over periods of time greater than about 200 milli-seconds, the region of the liquid crystalline layer corresponding to the shaped electrodes exhibits the focal-conic texture of the cholesteric mesophase and the background region of the liquid crystalline layer exhibits the Grandjean texture of the cholesteric mesophase.

In preferred embodiments of the present invention, as in the Examples, the liquid crystalline material initially provided in either the Grandjean texture or the focal-conic texture of the cholesteric mesophase, comprises a mixture of a nematic and an optically active material. The optically active material can be either mesomorphic or non-mesomorphic, as is well-known in the art. See, for example, U.S. Pat. No. 3,909,114, hereby expressly incorporated by reference, at Columns 5 and 6 thereof, for a listing of a whole host of nematic and mesomorphic and non-mesomorphic optically active materials which can be utilized. The combination of a nematic liquid crystalline material and an optically active material is particularly preferred to provide enhanced storage of the mixture of Grandjean and focal-conic textures provided in accordance with the practice of the present invention. Since the voltage applied to transform the initially Grandjean or focal-conic texture of the cholesteric mesophase into the nematic mesophase is decreased in magnitude over a period of time in accordance with the practice of the present invention, it will be appreciated that when the applied voltage is reduced in magnitude to about 0, the liquid crystalline layer must have "memory" or "storage" in order for the resulting Grandjean and focal-conic texture mixture to have persistence after the about zero applied voltage is reached. Liquid crystalline materials having the structure of the cholesteric mesophase exhibit this persistence or storage. Therefore, a cholesteric liquid crystalline material or a nematic liquid crystalline material and an optically active material can be employed to achieve this persistence or storage.

While the present invention has been described with respect to preferred embodiments, it will be appreciated, upon a reading of the present disclosure, that other modifications and variations may be made without de-

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parting from the spirit of the present invention. These are intended to be included within the scope of the present invention.

What is claimed is:

I. A method of forming a mixture of the Grandjean and focal-conic textures of the cholesteric mesophase, comprising:

(a) providing a liquid crystalline material in a texture selected from the group consisting of the Grandjean texture and the focal-conic texture of the cholesteric mesophase;

(b) applying an electrical field across said liquid crystalline material within the cholesteric-to-nematic electrical field range of said liquid crystalline material thereby transforming said liquid crystalline material from the cholesteric mesophase to the nematic mesophase; and

(c) decreasing the magnitude of said applied electrical field over a period of time effective to transform said liquid crystalline material from the nematic

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mesophase to said mixture of the Grandjean and focal-conic textures of the cholesteric mesophase.

2. The method of claim 1 wherein said period of time within step (c) is from about 10 to about 200 milliseconds.

3. The method according to claim 1 wherein said electrical field is applied in imagewise configuration.

4. The method of claim 1 wherein said liquid crystalline material comprises a nematic liquid crystalline material and an optically active material.

5. The method according to claim 1 wherein said liquid crystalline material is in the Grandjean texture of the cholesteric mesophase.

6. The method according to claim 5 wherein said electrical field is applied in imagewise configuration resulting in an imagewise configured mixture of the Grandjean and focal-conic textures of the cholesteric mesophase surrounded by a background region of the liquid crystalline material in the Grandjean texture of the cholesteric mesophase.

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EXHIBIT 8

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Form paragraph 7.43 can be used to state the objection.

¶ 7.43 *Objection to Claims, Allowable Subject Matter*

Claim [1] objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

608.01(o) Basis for Claim Terminology in Description [R-3]

The meaning of every term used in any of the claims should be apparent from the descriptive portion of the specification with clear disclosure as to its import; and in mechanical cases, it should be identified in the descriptive portion of the specification by reference to the drawing, designating the part or parts therein to which the term applies. A term used in the claims may be given a special meaning in the description. **>See MPEP § 2111.01 and § 2173.05(a).<

Usually the terminology of the original claims follows the nomenclature of the specification, but sometimes in amending the claims or in adding new claims, new terms are introduced that do not appear in the specification. The use of a confusing variety of terms for the same thing should not be permitted.

New claims and amendments to the claims already in the application should be scrutinized not only for new matter but also for new terminology. While an applicant is not limited to the nomenclature used in the application as filed, he or she should make appropriate amendment of the specification whenever this nomenclature is departed from by amendment of the claims so as to have clear support or antecedent basis in the specification for the new terms appearing in the claims. This is necessary in order to insure certainty in construing the claims in the light of the specification, *Ex parte Kotler*, 1901 C.D. 62, 95 O.G. 2684 (Comm'r Pat. 1901). See 37 CFR 1.75, MPEP § 608.01(i) and § 1302.01. Note that examiners should ensure that the terms and phrases used in claims presented late in prosecution of the application (including claims amended via an examiner's amendment) find clear support or antecedent basis in the description so that the meaning of the terms in the claims may be ascertainable by reference to the description, see 37 CFR 1.75(d)(1). If the examiner determines that the claims presented late in prosecution do not comply with 37 CFR 1.75(d)(1), applicant will be

required to make appropriate amendment to the description to provide clear support or antecedent basis for the terms appearing in the claims provided no new matter is introduced.

The specification should be objected to if it does not provide proper antecedent basis for the claims by using form paragraph 7.44.

¶ 7.44 *Claimed Subject Matter Not in Specification*

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: [1]

608.01(p) Completeness [R-3]

Newly filed applications obviously failing to disclose an invention with the clarity required are discussed in MPEP § 702.01.

A disclosure in an application, to be complete, must contain such description and details as to enable any person skilled in the art or science to which the invention pertains to make and use the invention as of its filing date. *In re Glass*, 492 F.2d 1228, 181 USPQ 31 (CCPA 1974).

While the prior art setting may be mentioned in general terms, the essential novelty, the essence of the invention, must be described in such details, including proportions and techniques, where necessary, as to enable those persons skilled in the art to make and utilize the invention.

Specific operative embodiments or examples of the invention must be set forth. Examples and description should be of sufficient scope as to justify the scope of the claims. *Markush* claims must be provided with support in the disclosure for each member of the *Markush* group. Where the constitution and formula of a chemical compound is stated only as a probability or speculation, the disclosure is not sufficient to support claims identifying the compound by such composition or formula.

A complete disclosure should include a statement of utility. This usually presents no problem in mechanical cases. In chemical cases, varying degrees of specificity are required.

A disclosure involving a new chemical compound or composition must teach persons skilled in the art how to make the compound or composition. Incomplete teachings may not be completed by reference to subsequently filed applications.

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For "Guidelines For Examination Of Applications For Compliance With The Utility Requirement of 35 U.S.C. 101," see MPEP § 2107.

For "General Principles Governing Utility Rejections," see MPEP § 2107.01.

For a discussion of the utility requirement under 35 U.S.C. 112, first paragraph, in drug cases, see MPEP § 2107.03 and § 2164.06(a).

For "Procedural Considerations Related to Rejections for Lack of Utility," see MPEP § 2107.02.

For "Special Considerations for Asserted Therapeutic or Pharmacological Utilities," see MPEP § 2107.03.

I. INCORPORATION BY REFERENCE

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37 CFR 1.57. *Incorporation by reference.*

(a) Subject to the conditions and requirements of this paragraph, if all or a portion of the specification or drawing(s) is inadvertently omitted from an application, but the application contains a claim under § 1.55 for priority of a prior-filed foreign application, or a claim under § 1.78 for the benefit of a prior-filed provisional, nonprovisional, or international application, that was present on the filing date of the application, and the inadvertently omitted portion of the specification or drawing(s) is completely contained in the prior-filed application, the claim under § 1.55 or § 1.78 shall also be considered an incorporation by reference of the prior-filed application as to the inadvertently omitted portion of the specification or drawing(s).

(1) The application must be amended to include the inadvertently omitted portion of the specification or drawing(s) within any time period set by the Office, but in no case later than the close of prosecution as defined by § 1.114 (b), or abandonment of the application, whichever occurs earlier. The applicant is also required to:

(i) Supply a copy of the prior-filed application, except where the prior-filed application is an application filed under 35 U.S.C. 111;

(ii) Supply an English language translation of any prior-filed application that is in a language other than English; and

(iii) Identify where the inadvertently omitted portion of the specification or drawings can be found in the prior-filed application.

(2) Any amendment to an international application pursuant to this paragraph shall be effective only as to the United States, and shall have no effect on the international filing date of the application. In addition, no request to add the inadvertently omitted portion of the specification or drawings in an international application designating the United States will be acted upon by the Office prior to the entry and commencement of the national stage (§ 1.491) or the filing of an application under 35 U.S.C. 111 (a) which claims benefit of the international application.

(3) If an application is not otherwise entitled to a filing date under § 1.53(b), the amendment must be by way of a petition pursuant to this paragraph accompanied by the fee set forth in § 1.17(f).

(b) Except as provided in paragraph (a) of this section, an incorporation by reference must be set forth in the specification and must:

(1) Express a clear intent to incorporate by reference by using the root words "incorporat(e)" and "reference" (e.g., "incorporate by reference"); and

(2) Clearly identify the referenced patent, application, or publication.

(c) "Essential material" may be incorporated by reference, but only by way of an incorporation by reference to a U.S. patent or U.S. patent application publication, which patent or patent application publication does not itself incorporate such essential material by reference. "Essential material" is material that is necessary to:

(1) Provide a written description of the claimed invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and set forth the best mode contemplated by the inventor of carrying out the invention as required by the first paragraph of 35 U.S.C. 112;

(2) Describe the claimed invention in terms that particularly point out and distinctly claim the invention as required by the second paragraph of 35 U.S.C. 112; or

(3) Describe the structure, material, or acts that correspond to a claimed means or step for performing a specified function as required by the sixth paragraph of 35 U.S.C. 112.

(d) Other material ("Nonessential material") may be incorporated by reference to U.S. patents, U.S. patent application publications, foreign patents, foreign published applications, prior and concurrently filed commonly owned U.S. applications, or non-patent publications. An incorporation by reference by hyperlink or other form of browser executable code is not permitted.

(e) The examiner may require the applicant to supply a copy of the material incorporated by reference. If the Office requires the applicant to supply a copy of material incorporated by reference, the material must be accompanied by a statement that the copy supplied consists of the same material incorporated by reference in the referencing application.

(f) Any insertion of material incorporated by reference into the specification or drawings of an application must be by way of an amendment to the specification or drawings. Such an amendment must be accompanied by a statement that the material being inserted is the material previously incorporated by reference and that the amendment contains no new matter.

(g) An incorporation of material by reference that does not comply with paragraphs (b), (c), or (d) of this section is not effective to incorporate such material unless corrected within any time period set by the Office, but in no case later than the close of prosecution as defined by § 1.114(b), or abandonment of the application, whichever occurs earlier. In addition:

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(1) A correction to comply with paragraph (b)(1) of this section is permitted only if the application as filed clearly conveys an intent to incorporate the material by reference. A mere reference to material does not convey an intent to incorporate the material by reference.

(2) A correction to comply with paragraph (b)(2) of this section is only permitted for material that was sufficiently described to uniquely identify the document.<

The Director has considerable discretion in determining what may or may not be incorporated by reference in a patent application. *General Electric Co. v. Brenner*, 407 F.2d 1258, 159 USPQ 335 (D.C. Cir. 1968). >Effective October 21, 2004, the Office codified in 37 CFR 1.57(b) – (g) existing practice with respect to explicit incorporations by reference with a few changes to reflect the eighteen-month publication of applications. In addition, 37 CFR 1.57(a) was added to provide a safeguard for applicants when a page(s) of the specification, or a portion thereof, or a sheet(s) of the drawing(s), or a portion thereof, is inadvertently omitted from an application, such as through a clerical error. 37 CFR 1.57(a) applies to applications filed on or after September 21, 2004. 37 CFR 1.57(a) permits inadvertently omitted material to be added to the application by way of a later filed amendment if the inadvertently omitted portion of the specification or drawing(s) is completely contained in a prior-filed application (for which priority/benefit is claimed) even though there is no explicit incorporation by reference of the prior-filed application. See MPEP § 201.17 for discussion regarding 37 CFR 1.57(a). <

The incorporation by reference practice with respect to applications which issue as U.S. patents provides the public with a patent disclosure which minimizes the public's burden to search for and obtain copies of documents incorporated by reference which may not be readily available. Through the Office's incorporation by reference policy, the Office ensures that reasonably complete disclosures are published as U.S. patents. The following is the manner in which the Director has elected to exercise that discretion. Section A provides the guidance for incorporation by reference in applications which are to issue as U.S. patents. Section B provides guidance for incorporation by reference in benefit applications; i.e., those domestic (35 U.S.C. 120) or foreign (35 U.S.C. 119(a)) applications relied on to establish an earlier effective filing date. See MPEP § 2181 for the impact

of incorporation by reference on the determination of whether applicant has complied with the requirements of 35 U.S.C. 112, second paragraph when 35 U.S.C. 112, sixth paragraph is invoked.

A. *Review of Applications Which Are To Issue as Patents.*

An application as filed must be complete in itself in order to comply with 35 U.S.C. 112. Material nevertheless may be incorporated by reference, *Ex parte Schwarze*, 151 USPQ 426 (Bd. App. 1966). An application for a patent when filed may incorporate "essential material" by reference to (1) a U.S. patent, >or< (2) a U.S. patent application publication, **>which patent or patent application publication does not itself incorporate such essential material by reference. See 37 CFR 1.57(c). Prior to October 21, 2004, Office policy also permitted incorporation by reference to <a pending U.S. application**.

"Essential material" is defined >in 37 CFR 1.57(c)< as that which is necessary to (1) **>provide a written description of the claimed invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and set forth the best mode contemplated by the inventor of carrying out the invention as required by the first paragraph of 35 U.S.C. 112, (2) describe the claimed invention in terms that particularly point out and distinctly claim the invention as required by the second paragraph of 35 U.S.C. 112, or (3) describe the structure, material, or acts that correspond to a claimed means or step for performing a specified function as required by the sixth paragraph of 35 U.S.C. 112. In any application that is to issue as a U.S. patent, essential material may only be incorporated by reference to a U.S. patent or patent application publication. The practice of permitting incorporation by reference of material from unpublished applications in which the issue fee was paid was discontinued by rule on October 21, 2004.

Other material ("nonessential subject matter")< may be incorporated by reference to (1) patents or applications published by the United States or foreign countries or regional patent offices, (2) prior >and concurrently< filed, commonly owned U.S. applications, or (3) non-patent publications **. Nonessential

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subject matter is subject matter referred to for purposes of indicating the background of the invention or illustrating the state of the art.

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An incorporation by reference by hyperlink or other form of browser executable code is not permitted. See 37 CFR 1.57(d) and MPEP § 608.01.

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Mere reference to another application, patent, or publication is not an incorporation of anything therein into the application containing such reference for the purpose of the disclosure required by 35 U.S.C. 112, first paragraph. *In re de Seversky*, 474 F.2d 671, 177 USPQ 144 (CCPA 1973). >37 CFR 1.57(b)(1) limits a proper incorporation by reference (except as provided in 37 CFR 1.57(a)) to instances only where the perfecting words "incorporated by reference" or the root of the words "incorporate" (e.g., incorporating, incorporated) and "reference" (e.g., referencing) appear. The requirement for specific root words will bring greater clarity to the record and provide a bright line test as to where something is being referred to is an incorporation by reference. The Office intends to treat references to documents that do not meet this "bright line" test as noncompliant incorporations by reference and may require correction pursuant to 37 CFR 1.57(g). If a reference to a document does not clearly indicate an intended incorporation by reference, examination will proceed as if no incorporation by reference statement has been made and the Office will not expend resources trying to determine if an incorporation by reference was intended. < In addition to other requirements for an application, the referencing application *must< include an identification of the referenced patent, application, or publication. >See 37 CFR 1.57(b)(2)< Particular attention should be directed to specific portions of the referenced document where the subject matter being incorporated may be found. Guidelines for situations where applicant is permitted to fill in a number for Application No. _____ left blank in the application as filed can be found in *In re Fouché*, 439 F.2d 1237, 169 USPQ 429 (CCPA 1971) (Abandoned applications less than 20 years old can be incorporated by reference to the same extent as copending applications; both types are open to the public upon the referencing application issuing as a patent. See >37 CFR 1.14(a)(i)(iv) and (vi) and< MPEP § 103).

1. Complete Disclosure Filed

If an application is filed with a complete disclosure, essential material may be canceled by amendment and may be substituted by reference to a U.S. patent or **>a U.S. patent application publication.< The amendment must be accompanied by **>a statement< signed by the applicant, or a practitioner representing the applicant, stating that the material canceled from the application is the same material that has been incorporated by reference >and no new matter has been included (see 37 CFR 1.57(f). The same procedure is available for nonessential material.<

If an application as filed incorporates * material by reference **>, a copy of the incorporated by reference material may be required to be submitted to the Office even if the material is properly incorporated by reference. The examiner may require a copy of the incorporated material to review and to understand what is being incorporated or to put the description of the material in its proper context. Another instance where a copy of the incorporated material may be required is where the material is being inserted by amendment into the body of the application to replace an improper incorporation by reference statement so that the Office can determine that the material being added by amendment in lieu of the incorporation is the same material as was attempted to be incorporated. If the Office requires the applicant to supply a copy of the material incorporated by reference, the material must be accompanied by a statement that the copy supplied consists of the same material incorporated by reference in the referencing application. See 37 CFR 1.57(e).<

2. Improper Incorporation

**

>37 CFR 1.57(f) addresses corrections of incorporation by reference by inserting the material previously incorporated by reference. A noncompliant incorporation by reference statement may be corrected by an amendment. 37 CFR 1.57(f). However, the amendment must not include new matter. Incorporating by reference material that was not incorporated by reference on filing of an application may introduce new matter. An incorporation by reference of essential material to an unpublished U.S. patent application, a foreign application or patent, or to a publication is improper under 37 CFR 1.57(c). The improper incor-

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poration by reference is not effective to incorporate the material unless corrected by the applicant (37 CFR 1.57(g)). Any underlying objection or rejection (e.g., under 35 U.S.C. 112) should be made by the examiner until applicant corrects the improper incorporation by reference by submitting an amendment to amend the specification or drawings to include the material incorporated by reference. A statement that the material being inserted is the material previously incorporated by reference and that the amendment contains no new matter is also required. 37 CFR 1.57(f). See also *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973). Improper incorporation by reference statements and late corrections thereof require expenditure of unnecessary examination resources and slow the prosecution process. Applicants know (or should know) whether they want material incorporated by reference, and must timely correct any incorporation by reference errors. Correction must be done within the time period set forth in 37 CFR 1.57(g).

An incorporation by reference that does not comply with 37 CFR 1.57(b), (c), or (d) is not effective to incorporate such material unless corrected within any time period set by the Office (should the noncompliant incorporation by reference be first noticed by the Office and applicant informed thereof), but in no case later than the close of prosecution as defined by 37 CFR 1.114(b) (should applicant be the first to notice the noncompliant incorporation by reference and the Office informed thereof), or abandonment of the application, whichever occurs earlier. The phrase "or abandonment of the application" is included in 37 CFR 1.57(g) to address the situations where an application is abandoned prior to the close of prosecution, e.g., the situation where an application is abandoned after a non-final Office action.

37 CFR 1.57(g)(1) authorizes the correction of non-compliant incorporation by reference statements that do not use the root of the words "incorporate" and "reference" in the incorporation by reference statement. This correction cannot be made when the material was merely referred to and there was no clear specific intent to incorporate it by reference.

37 CFR 1.57(g)(2) states that a citation of a document can be corrected where the document is sufficiently described to uniquely identify the document. Correction of a citation for a document that cannot be identified as the incorporated document may be new matter and is not authorized by 37 CFR 1.57(g)(2). An example would be where applicant intended to incorporate a particular journal article but supplied the citation information for a completely unrelated book by a different author, and there is no other information to identify the correct journal article. Since it cannot be determined from the citation originally supplied what article was intended to be incorporated, it would be improper (e.g., new matter) to replace the original incorporation by reference with the intended incorporation by reference. A citation of a patent application by attorney docket number, inventor name, filing date and title of invention may sufficiently describe the document, but even then correction should be made to specify the application number.

A petition under 37 CFR 1.183 to suspend the time period requirement set forth in 37 CFR 1.57(g) will not be appropriate. After the application has been abandoned, applicant must file a petition to revive under 37 CFR 1.137 for the purpose of correcting the incorporation by reference. After the application has issued as a patent, applicant may correct the patent by filing a reissue application. Correcting an improper incorporation by reference with a certificate of correction is not an appropriate means of correction because it may alter the scope of the claims. The scope of the claims may be altered because 37 CFR 1.57(g) provides that an incorporation by reference that does not comply with paragraph (b), (c), or (d) is not an effective incorporation. For example, an equivalent means omitted from a patent disclosure by an ineffective incorporation by reference would be outside the scope of the patented claims. Hence, a correction of an incorporation by reference pursuant to 37 CFR 1.57 may alter the scope of the claims by adding the omitted equivalent means. Changes involving the scope of the claims should be done via the reissue process. Additionally, the availability of the reissue process for corrections would make a successful showing required under 37 CFR 1.183 unlikely. The following examples show when an improper incorporation by reference is required to be corrected:

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Example 1:

Upon review of the specification, the examiner noticed that the specification included an incorporation by reference statement incorporating essential material disclosed in a foreign patent. In a non-final Office action, the examiner required the applicant to amend the specification to include the essential material.

In reply to the non-final Office action, applicant must correct the improper incorporation by reference by filing an amendment to add the essential material disclosed in the foreign patent and a statement in compliance with 37 CFR 1.57(f) within the time period for reply set forth in the non-final Office action.

Example 2:

Upon review of the specification, the examiner determined that the subject matter incorporated by reference from a foreign patent was "nonessential material" and therefore, did not object to the incorporation by reference. In reply to a non-final Office action, applicant filed an amendment to the claims to add a new limitation that was supported only by the foreign patent. The amendment filed by the applicant caused the examiner to re-determine that the incorporated subject matter was "essential material" under 37 CFR 1.57(c). The examiner rejected the claims that include the new limitation under 35 U.S.C. 112, first paragraph, in a final Office action.

Since the rejection under 35 U.S.C. 112, first paragraph was necessitated by the applicant's amendment, the finality of the Office action is proper. If the applicant wishes to overcome the rejection under 35 U.S.C. 112, first paragraph by filing an amendment under 37 CFR 1.57(f) to add the subject material disclosed in the foreign patent into the specification, applicant may file the amendment as an after final amendment in compliance with 37 CFR 1.116. Alternatively, applicant may file an RCE under 37 CFR 1.114 accompanied by the appropriate fee, and an amendment per 37 CFR 1.57(f) within the time period for reply set forth in the final Office action.

The following form paragraphs may be used:

¶ 6.19 Incorporation by Reference, Unpublished U.S. Application, Foreign Patent or Application, Publication

The incorporation of essential material in the specification by reference to an unpublished U.S. application, foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference, if the material is relied upon to overcome any objection, rejection, or other requirement imposed by the Office. The amendment must be accompanied by a statement executed by the applicant, or a practitioner representing the applicant, stating that the material being inserted is the material previously incorporated by reference and that the amendment contains no new matter. 37 CFR 1.57(f).

Examiner Note:

Since the material that applicant is attempting to incorporate in the specification is considered to be essential material, an appropriate objection to the specification and/or rejection of the claim(s) under 35 U.S.C. 112, should be made. One or more of form paragraphs 7.31.01 to 7.31.04, as for example, should be used following this form paragraph.

¶ 6.19.01 Ineffective Incorporation by Reference, General

The attempt to incorporate subject matter into this application by reference to [1] is ineffective because [2].

Examiner Note:

1. In bracket 1, identify the document such as an application or patent number or other identification.
2. In bracket 2, give reason(s) why it is ineffective (e.g., the root words "incorporate" and/or "reference" have been omitted, see 37 CFR 1.57(b)(1); the reference document is not clearly identified as required by 37 CFR 1.57(b)(2)).
3. This form paragraph should be followed by form paragraph 6.19.03.

¶ 6.19.03 Correction of Ineffective Incorporation by Reference

The incorporation by reference will not be effective until correction is made to comply with 37 CFR 1.57(b), (c), or (d). If the incorporated material is relied upon to meet any outstanding objection, rejection, or other requirement imposed by the Office, the correction must be made within any time period set by the Office for responding to the objection, rejection, or other requirement for the incorporation to be effective. Compliance will not be held in abeyance with respect to responding to the objection, rejection, or other requirement for the incorporation to be effective. In no case may the correction be made later than the close of prosecution as defined in 37 CFR 1.114(b), or abandonment of the application, whichever occurs earlier.

Any correction inserting material by amendment that was previously incorporated by reference must be accompanied by a statement that the material being inserted is the material incorpo-

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rated by reference and the amendment contains no new matter. 37 CFR 1.57(f).

The filing date of any application wherein essential material is improperly incorporated by reference will not be affected by applicant's correction where (A) there is a clear intent to incorporate by reference the intended material and the correction is to add the root words of "incorporate" and "reference," (B) the incorporated document can be uniquely identified and the correction is to clarify the document's identification, and (C) where the correction is to insert the material from the reference where incorporation is to an unpublished U.S. patent application, foreign application or patent, or to a publication.<

Reliance on a commonly assigned >, prior filed or concurrently filed< copending application by a different inventor may ordinarily be made for the purpose of completing the disclosure >provided the incorporated material is directed to nonessential material. See 37 CFR 1.57(d)<. See *In re Fried*, 329 F.2d 323, 141 USPQ 27 (CCPA 1964), and *General Electric Co. v. Brenner*, 407 F.2d 1258, 159 USPQ 335 (D.C. Cir. 1968).

Since a disclosure must be complete as of the filing date, subsequent publications or subsequently filed applications cannot be relied on to establish a constructive reduction to practice or an enabling disclosure as of the filing date. *White Consol. Indus., Inc. v. Vega Servo-Control, Inc.*, 713 F.2d 788, 218 USPQ 961 (Fed. Cir. 1983); *In re Scarbrough*, 500 F.2d 560, 182 USPQ 298 (CCPA 1974); *In re Glass*, 492 F.2d 1228, 181 USPQ 31 (CCPA 1974).

B. Review of Applications Which Are Relied on To Establish an Earlier Effective Filing Date.

The limitations on the material which may be incorporated by reference in U.S. patent applications which are to issue as U.S. patents do not apply to applications relied on only to establish an earlier effective filing date under 35 U.S.C. 119 or 35 U.S.C. 120. Neither 35 U.S.C. 119(a) nor 35 U.S.C. 120 places any restrictions or limitations as to how the claimed invention must be disclosed in the earlier application to comply with 35 U.S.C. 112, first paragraph. Accordingly, an application is entitled to rely upon the filing date of an earlier application, even if the earlier application itself incorporates essential material by reference to another document. See *Ex parte Maziere*,

27 USPQ2d 1705, 1706-07 (Bd. Pat. App. & Inter. 1993).

The reason for incorporation by reference practice with respect to applications which are to issue as U.S. patents is to provide the public with a patent disclosure which minimizes the public's burden to search for and obtain copies of documents incorporated by reference which may not be readily available. Through the Office's incorporation by reference policy, the Office ensures that reasonably complete disclosures are published as U.S. patents. The same policy concern does not apply where the sole purpose for which an applicant relies on an earlier U.S. or foreign application is to establish an earlier filing date. Incorporation by reference in the earlier application of (1) patents or applications published by foreign countries or regional patent offices, (2) nonpatent publications, (3) a U.S. patent or application which itself incorporates "essential material" by reference, or (4) a foreign application, is not critical in the case of a "benefit" application.

When an applicant, or a patent owner in a reexamination or interference, claims the benefit of the filing date of an earlier application which incorporates material by reference, the applicant or patent owner may be required to supply copies of the material incorporated by reference. For example, an applicant may claim the benefit of the filing date of a foreign application which itself incorporates by reference another earlier filed foreign application. If necessary, due to an intervening reference, applicant should be required to supply a copy of the earlier filed foreign application, along with an English language translation. A review can then be made of the foreign application and all material incorporated by reference to determine whether the foreign application discloses the invention sought to be patented in the manner required by the first paragraph of 35 U.S.C. 112 so that benefit may be accorded. *In re Gosteli*, 872 F.2d 1008, 10 USPQ2d 1614 (Fed. Cir. 1989).

As a safeguard against the omission of a portion of a prior application for which priority is claimed under 35 U.S.C. 119(a)-(d) or (f), or for which benefit is claimed under 35 U.S.C. 119(e) or 120, applicant may include a statement at the time of filing of the later application incorporating by reference the prior application. See MPEP § 201.06(c) >and § 201.11< where domestic benefit is claimed. See MPEP § 201.13

PARTS, FORM, AND CONTENT OF APPLICATION

608.01(q)

where foreign priority is claimed. >See MPEP § 201.17 regarding 37 CFR 1.57(a) for applications filed on or after September 21, 2004.< The inclusion of such an incorporation by reference statement in the later-filed application will permit applicant to include subject matter from the prior application into the later-filed application without the subject matter being considered as new matter. For the incorporation by reference to be effective as a proper safeguard, the incorporation by reference statement must be filed at the time of filing of the later-filed application. An incorporation by reference statement added after an application's filing date is not effective because no new matter can be added to an application after its filing date (see 35 U.S.C. 132(a)).

II. SIMULATED OR PREDICTED TEST RESULTS OR PROPHETIC EXAMPLES

Simulated or predicted test results and prophetic examples (paper examples) are permitted in patent applications. Working examples correspond to work actually performed and may describe tests which have actually been conducted and results that were achieved. Paper examples describe the manner and process of making an embodiment of the invention which has not actually been conducted. Paper examples should not be represented as work actually done. No results should be represented as actual results unless they have actually been achieved. Paper examples should not be described using the past tense. *Hoffman-La Roche, Inc. v. Promega Corp.*, 323 F.3d 1354, 1367, 66 USPQ2d 1385, 1394 (Fed. Cir. 2003).

For problems arising from the designation of materials by trademarks and trade names, see MPEP § 608.01(v).

608.01(q) Substitute or Rewritten Specification [R-3]

37 CFR 1.125. *Substitute specification.*

(a) If the number or nature of the amendments or the legibility of the application papers renders it difficult to consider the application, or to arrange the papers for printing or copying, the Office may require the entire specification, including the claims, or any part thereof, be rewritten.

(b) Subject to § 1.312, a substitute specification, excluding the claims, may be filed at any point up to payment of the issue fee if it is accompanied by a statement that the substitute specification includes no new matter.

(c) A substitute specification submitted under this section must be submitted with markings showing all the changes relative to the immediate prior version of the specification of record. The text of any added subject matter must be shown by underlining the added text. The text of any deleted matter must be shown by strike-through except that double brackets placed before and after the deleted characters may be used to show deletion of five or fewer consecutive characters. The text of any deleted subject matter must be shown by being placed within double brackets if strike-through cannot be easily perceived. An accompanying clean version (without markings) must also be supplied. Numbering the paragraphs of the specification of record is not considered a change that must be shown pursuant to this paragraph.

(d) A substitute specification under this section is not permitted in a reissue application or in a reexamination proceeding.

The specification is sometimes in such faulty English that a new specification is necessary; in such instances, a new specification should be required.

Form paragraph 6.28 may be used where the specification is in faulty English.

**>

¶ 6.28 Idiomatic English

A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter.

37 CFR 1.125(a) applies to a substitute specification required by the Office. If the number or nature of the amendments or the legibility of the application papers renders it difficult to consider the application, or to arrange the papers for printing or copying, the Office may require the entire specification, including the claims, or any part thereof be rewritten.

Form paragraph 6.28.01 may be used where the examiner, for reasons other than faulty English, requires a substitute specification.

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¶ 6.28.01 Substitute Specification Required by Examiner

A substitute specification [1] the claims is required pursuant to 37 CFR 1.125(a) because [2].

A substitute specification must not contain new matter. The substitute specification must be submitted with markings showing all the changes relative to the immediate prior version of the specification of record. The text of any added subject matter must be shown by underlining the added text. The text of any deleted matter must be shown by strikethrough except that double brackets placed before and after the deleted characters may be used to show deletion of five or fewer consecutive characters. The text of any deleted subject matter must be shown by being placed within double brackets if strikethrough cannot be easily perceived. An accompanying clean version (without markings) and a statement

EXHIBIT 9

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Patent License Proposal
Callaway Golf
12/18/00

License:	Non-exclusive	
Term:	1/1/00 – last patent expires	
Product Covered:	All products (i) covered by an issued, unexpired patent, or (ii) made using an apparatus or process covered by an issued, unexpired patent	
Territory:	Any country where relevant patents are issued and unexpired	
Patents:	Lynch Group	US Patent # 5,080,367 4,936,587
	Hebert Group	6,132,324 5,885,172
	Calabria Group	6,042,768 5,947,813 5,897,884 5,888,437 5,733,428
	Includes any divisions, continuations, continuations-in-part and all foreign patents corresponding thereto to the extent that they cover Callaway commercially introduced product in existence as of 1/1/01.	
Royalty:	Lynch Group	.5% of Net Sales
	Hebert Group	3.0% of Net Sales
	Calabria Group	4.5% of Net Sales
	Total	8.0% of Net Sales

Net Sales = gross receipts for product sold by Callaway or affiliates, less allowances for terms discounts and returns

Royalty rates offered for all patents to be used as a package only.

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CW 0274559

EXHIBIT 10



Federal Register

Tuesday,
August 21, 2007

Part II

Department of Commerce

Patent and Trademark Office

37 CFR Part 1

**Changes To Practice for Continued
Examination Filings, Patent Applications
Containing Patentably Indistinct Claims,
and Examination of Claims in Patent
Applications; Final Rule**

Continuations, 84-B.U. L. Rev. 63, 64 (2004). The burden imposed by the repetitive filing of applications (as continuing applications) on the Office (as well as on the public) is not a recent predicament. See *To Promote the Progress of Useful Arts, Report of the President's Commission on the Patent System*, at 17-18 (1966) (recommending changes to prevent the repetitive filing of dependent (i.e., continuing) applications). Unrestricted continued examination filings and multiple applications containing patentably indistinct claims, however, are now having such an impact on the Office's ability to examine new applications that it is appropriate for the Office to clarify the applicant's duty to advance applications to final action by placing some conditions on the filing of multiple continuing applications, requests for continued examination, and other multiple applications to the same invention. See 35 U.S.C. 2(b) (authorizes the Office to establish regulations, not inconsistent with law, which shall govern the conduct of proceedings in the Office, and shall facilitate and expedite the processing of patent applications). The changes in this final rule will permit the Office to apply the patent examining resources otherwise consumed by these applications to the examination of new applications and thereby reduce the backlog of unexamined applications.

The Office also notes that not every application as filed particularly points out and distinctly claims what the applicant regards as his or her invention. For example, this may occur where the applicant's attorney or agent has not adequately reviewed or revised the application documents received from the applicant. Applicants frequently file literal translations of foreign documents as applications, resulting in problems with compliance with U.S. patent law, such as the written description requirement, as well as problems with formatting and presentation of the claims. In these situations, examination of what applicants actually regard as their invention may not begin until after one or more continued examination filings. Applicants should not rely on an unlimited number of continued examination filings to correct deficiencies in the claims and disclosure that applicant or applicant's representative could have corrected earlier. In addition, while only a small minority of applications are a third or subsequent continuing application, it appears that some applicants and practitioners have used multiple

continued-examination filings as a strategy to delay the conclusion of examination. The Office, however, considers such a strategy to be a misuse of continued examination practice. Specifically, the Office considers such a strategy to be inconsistent with an applicant's and practitioner's duty under 37 CFR 10.18(b)(2)(i) not to submit an application or other filing to cause unnecessary delay or needless increase in the cost of prosecution before the Office. This misuse of continued examination practice also prejudices the public by keeping applications in pending status while awaiting developments in similar or parallel technology and then later amending their applications to cover these developments. The courts have permitted the addition of claims, when supported under 35 U.S.C. 112, § 1, to encompass products or processes later discovered in the marketplace. See *PIN/ NIP, Inc. v. Platt Chemical Co.*, 304 F.3d 1235, 1247, 64 U.S.P.Q.2d 1344, 1352 (Fed. Cir. 2002). However, the practice of maintaining continuing applications to delay the conclusion of examination for the purpose of adding claims after such discoveries is inconsistent with the duty under 37 CFR 10.18(b)(2)(i) not to submit filings to cause unnecessary delay or needless increase in the cost of prosecution before the Office.

The Office, in light of its backlog and anticipated continued increase in application filings, is making every effort to become more efficient. Achieving greater efficiency requires the cooperation of those who provide the input into the examination process, the applicants and their representatives.

In the Continuing Applications Proposed Rule, the Office proposed to change the rules of practice to require that: (1) Any second or subsequent continued examination filing (continuation or continuation-in-part application or request for continued examination) include a showing that the amendment, argument, or evidence could not have been submitted prior to the close of prosecution after a single continuation or continuation-in-part application or request for continued examination; and (2) multiple applications that have the same claimed filing or priority date, substantial overlapping disclosure, a common inventor, and a common assignee include either an explanation of how the claims are patentably distinct, or a terminal disclaimer and explanation of why patentably indistinct claims have been filed in multiple applications.

In response to the comments on the proposed changes to the practices for continued examination filings, the

Office has modified these provisions relative to proposed changes. Under this final rule, an applicant may instead file two continuation applications (or two continuation-in-part applications, or one continuation application and one continuation-in-part application), plus a request for continued examination in any one of the initial application or two continuation or continuation-in-part applications, without any justification. Any additional continuation application, continuation-in-part application, or request for continued examination, however, must be filed to obtain consideration of an amendment, argument, or evidence, and be supported by a showing as to why the amendment, argument, or evidence sought to be entered could not have been previously submitted. This final rule would also ease the burden of examining multiple applications that have the same claimed filing or priority date, substantial overlapping disclosure, a common inventor, and common assignee by requiring that all patentably indistinct claims in such applications be submitted in a single application absent good and sufficient reason.

As discussed previously, the unrestricted continued examination practice and the filing of multiple applications containing patentably indistinct claims are impairing the Office's ability to examine new applications without real certainty that these practices effectively advance prosecution, improve patent quality, or serve the typical applicant or the public. These changes to the rules in title 37 of the CFR are intended to ensure that continued examination filings are used efficiently to move applications forward. The Office expects that the changes to the rules of practice in this final rule will: (1) Lead to more focused and efficient examination, improve the quality of issued patents, result in patents that issue faster, and give the public earlier notice of what the patent claims cover; and (2) address the growing practice of filing (by a common applicant or assignee) multiple applications containing patentably indistinct claims.

35 U.S.C. 111(a) and 120, respectively, permit an applicant to file a nonprovisional application and to claim the benefit of a prior-filed nonprovisional application. Similarly, 35 U.S.C. 363 and 365(c), respectively, permit an applicant to file an international application under Patent Cooperation Treaty (PCT) Article 11 and 35 U.S.C. 363 and, if the international application designates the United States of America, to claim the benefit of a prior-filed international application